BULLETIN No. 10

U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF BIOLOGICAL SURVEY

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LIFE ZONES AND CROP ZONES

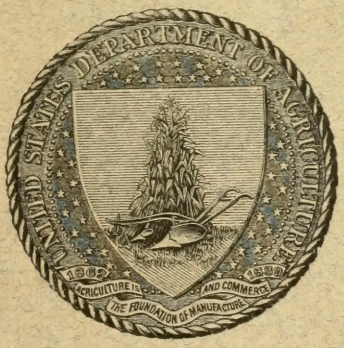
OF

THE UNITED STATES

BY

C. HART MERRIAM

Chief, Biological Survey



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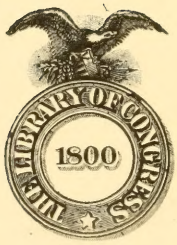

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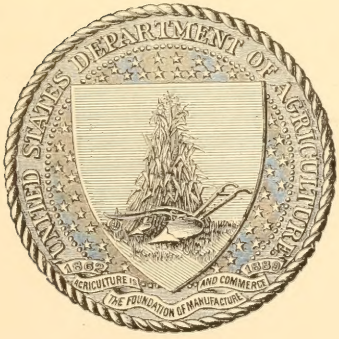

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BIOLOGICAL SURVEY,
Washington, D. C., June 20, 1898.

SIR: I have the honor to transmit herewith for publication, as Bulletin No. 10 of this division, a report on the work of the Biological Survey in its relation to practical agriculture, comprising a reprint of the article on the subject in the Yearbook of the United States Department of Agriculture for 1897 and considerable additional matter. This report is accompanied by a new map of the life zones of the United States, corrected to December, 1897, and consists of four parts, as follows:

I. Relations of the Biological Survey to practical agriculture.

II. Life zones of the United States: Boundaries, native species, and important crops.

III. Laws of temperature control of the geographic distribution of animals and plants.

IV. Crop tables.

It is hoped that this report, with its accompanying zone map and crop lists, will serve to emphasize the extreme wastefulness of indiscriminate experimentation, by which hundreds of thousands of dollars are thrown away each year in futile attempts to make crops grow in areas totally unfitted for their cultivation.

Respectfully,

C. HART MERRIAM,
Chief, Biological Survey.

Hon. JAMES WILSON,
Secretary of Agriculture.

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INTRODUCTION.

For ten years the Biological Survey (and its predecessor, the Division of Ornithology and Mammalogy) has had small parties in the field traversing the public domain for the purpose of studying the geographic distribution of our native land animals and plants and mapping the boundaries of the areas they inhabit. The present report is intended to explain the relations of this work to practical agriculture and to show the results thus far attained—it does not deal with other investigations carried on by the Survey.

It was early learned that North America is divisible into seven transcontinental belts or *life zones* and a much larger number of minor areas or *faunas*, each characterized by particular associations of animals and plants. It was then suspected that these same zones and areas, up to the northern limit of profitable agriculture, are adapted to the needs of particular kinds or varieties of cultivated crops, and this has since been fully established. When, therefore, the natural life zones and areas, seemingly of interest only to the naturalist, were found to be natural crop belts and areas, they became at once of the highest importance to the agriculturist. A map showing their position and boundaries, so far as ascertained at the close of the field season of 1897, accompanies this report, and lists of the more important crops of each belt and its principal subdivisions are here for the first time published. The matter relating to the native animals and plants has been reduced to a fragmentary outline, for the reason that this branch of the subject is of comparatively little interest to the farmer and fruit grower.

Under the head 'Important crops,' and in the corresponding 'Crop tables' at the end of the report, great care has been taken to make the lists accurate and trustworthy *as far as they go*. One of the chief difficulties encountered is that nearly all of the published matter relating to the distribution of crops is arranged by political divisions, as States or counties, and consequently is of little assistance as a guide to climatic or zone requirements. Another difficulty is the over sanguine attitude of many fruit growers and horticultural societies, particularly in the West, where innumerable varieties are reported as succeeding in places where they have not been tested a sufficient length of time. The intention in the present report has been to omit doubtful records, and since reliable information from specific localities of known zone position is exceedingly scarce, it is

obvious that the lists are very incomplete. They should be taken as a base on which to build.

Statistical information has been freely furnished by Mr. John Hyde, Statistician of the Department. The data on the distribution of cereals I have compiled from a study of the manuscript maps accompanying a report by Prof. C. S. Plumb, about to be published by the Biological Survey. The data on fruits and other crops have been obtained from various sources, published and unpublished. Among the former may be mentioned the 'Catalogue of Fruits' of the American Pomological Society (Bull. 6, Div. Pomology, U. S. Department Agriculture), reports of several State boards of horticulture, and reports of the State Board of Trade of California. Special information on Arizona has been contributed by Prof. J. W. Toumey; on Florida, by Mr. Herbert J. Webber; on California, by Prof. E. J. Wickson; on Washington, by Mr. Jesse Baker, and on the Snake River Valley at Lewiston, Idaho, and adjacent parts of Washington, by Mr. E. H. Libby, president of the Lewiston Water and Power Company, and Henry H. Spalding, of Almota, Wash. But most of all I am indebted to the courtesy of the Division of Pomology of the United States Department of Agriculture, and particularly to Mr. William A. Taylor, assistant pomologist, who has kindly gone over and corrected the various fruit lists with me and has made the nomenclature conform to the rules of the American Pomological Society. Without Mr. Taylor's invaluable assistance these lists would not have been fit for publication.

Corrections and additions are earnestly desired in order that subsequent editions of the report, which is intended to serve as a guide and index to the crop adaptations of the various life zones and areas, may be made more complete and useful. The list of miscellaneous crops here given is regrettably meager, and nothing whatever is said of the varieties of tobacco, tomatoes, eggplants, pumpkins, squashes, beans, pease, potatoes, or other garden vegetables. It is hoped the necessary data on these will be obtained in time for insertion in the next edition.

C. H. M.

LIFE ZONES AND CROP ZONES OF THE UNITED STATES.

PART I.

RELATIONS OF THE BIOLOGICAL SURVEY TO PRACTICAL AGRICULTURE.

The Biological Survey aims to define and map the natural agricultural belts of the United States, to ascertain what products of the soil can and what can not be grown successfully in each, to guide the farmer in the intelligent introduction of foreign crops, and to point out his friends and his enemies among the native birds and mammals, thereby helping him to utilize the beneficial and ward off the harmful kinds.

No fact is better recognized by thoughtful students of our resources than the need of diversifying our agricultural products, with a view not only to remedying the present unequal apportionment of standard crops throughout the United States, but also with a view to the introduction of new kinds. This is the more important because of the varying market values of standard crops from year to year, prices frequently falling so low as barely to cover cost of production, bringing hardship if not financial ruin to the producer. In order to obviate so far as possible the disastrous effects of such years it would seem the part of wisdom to be prepared with two or more crops, so that if one fails by reason of unsuitable seasonal conditions or low price the other can be depended on for sufficient revenue to bridge over the period of loss from failure of the first.

Farms so favorably situated that absolute reliance can be placed on a single crop, or so little diversified that all parts are equally fitted for this crop, are few and far between; and even in such cases there is danger of overproduction. As a rule, if the major part is well adapted for corn, wheat, cotton, sugar, or tobacco, the crop chosen is subject to material fluctuations in yield and value, and minor areas are better fitted for some other use.

NEED OF DIVERSIFICATION OF CROPS.

The Statistician of the Department, in his last report to the Secretary, calls attention to the marked geographic concentration of agricultural productions, and points out that "twenty-five States, or just half the total number, produce 98 per cent of the cotton, 95 per cent

of the corn, 95 per cent of the barley, 93 per cent of the oats, and from eight-tenths to nine-tenths of the wheat, rye, buckwheat, tobacco, potatoes, and hay produced in the entire country." This certainly is an unfortunate state of affairs, and one which, in the light of present knowledge of crop adaptations, seems unnecessary. At the same time, it is well to keep in mind the distinction between crops raised for home consumption and those raised for export. If, for instance, the twenty-five States and Territories now producing collectively less than 5 per cent of the total output of cereals can, by selecting proper varieties, grow enough for their own use, they may be able to raise for export fruits or other crops far more valuable to them than an excess of cereals.

For several years prior to 1897[1] the price of wheat in the North and West was so low as hardly to cover the cost of harvesting, while in the Southern States not enough was raised for local consumption, and the price was correspondingly high. Thus, in 1894 the price of wheat on the farm in the Dakotas, Oregon, and Washington ranged from 39 to 46 cents per bushel, while in South Carolina, Alabama, and Georgia it brought from 76 to 87 cents, and in Arizona $1. If a wheat can be found which may be depended upon to mature a good yield on suitable soils in the Southern States great benefit to the people should accrue therefrom. Recent investigations carried on in the Biological Survey by Prof. C. S. Plumb show that Fultz wheat and the spring or May wheats (including red May, early May, late May, big May, and others) may be grown successfully, except in the lowlands, in what is known as the Austroriparian zone, a belt which covers the greater part of South Carolina, Georgia, Alabama, Mississippi, Louisiana, and central Texas; and that Sonoran and Australian wheat do well in the Lower Sonoran belt in Arizona and southern California. Similarly, oats, in the main a Northern crop, has been found to do well in the Austroriparian belt of the Southern States if proper varieties are chosen; and these varieties are the Burt and Red Rust Proof. In the case of corn, Moseby's Prolific, Golden Dent, and White Gourd Seed seem well adapted to the same belt. So there appears to be no reason why cereals can not be grown in the Southern States in quantities more than sufficient for local consumption.

Cotton is the staple crop of the South, far exceeding all others in money value. But during 1897 the price of cotton was so low as to yield no profit, while at the same time wheat was so high that if a fair division of acreage had been made between the two, the Southern planters would have realized handsome profits instead of suffering financial distress. Attention must be called also to the fact that in

[1] In 1897 the price of wheat was so high that in Oregon and Washington the farm value was 70 cents per bushel, and the crop was so large (more than 38,000,000 bushels) that its farm value in Washington was $13,684,761, and in Oregon $13,071,622, or a total for the two States of nearly $27,000,000.

the face of the very large crop and extreme low price of cotton in 1897, when our export amounted to $212,640,769 (and similarly in 1894, when we exported $210,000,000 worth), enormous quantities were imported from Egypt. This, while inferior to our Sea Island cotton, is of higher grade than our ordinary product and is used "for goods requiring smooth finish and high luster. It gives to fabrics a soft finish somewhat like silk." During the fiscal year 1896 the value of the Egyptian cotton imported into this country was more than $5,000,000, and in 1897, $4,277,618. This brings up the important question whether we can not, with the aid of irrigation, raise these high-grade varieties in certain parts of the arid Southwest—in southern Arizona and the desert region of southern California.

SEA ISLAND AND EGYPTIAN COTTON FOR NEW SECTIONS.

The history of Sea Island cotton is interesting, as showing how the intelligent introduction and cultivation of choice crops in suitable climatic areas may yield rich returns. Dr. Walter H. Evans states that the Sea Island cotton, whose fiber is so highly prized, "is indigenous to the Lesser Antilles, and probably to San Salvador, the Bahamas, Barbados, Guadeloupe, and other islands between 12° and 26° north latitude. By cultivation it has been extended throughout the West Indies, the maritime coast of the Southern States, Central America, Puerto Rico, Jamaica, etc., southern Spain, Algeria, the islands and coast of western tropical Africa, Egypt, Island of Bourbon, East Indies, Queensland, New South Wales, etc. It may be cultivated in any region adapted to the olive and near the sea, the principal requisite being a hot and humid atmosphere; but the results of acclimatization indicate that the humid atmosphere is not entirely necessary if irrigation be employed, as this species is undoubtedly grown extensively in Egypt."

Although the area in which Sea Island cotton is produced in the United States is very small, and although a large quantity is manufactured in our country, still the value of the crop exported amounted in 1894 to nearly $3,000,000, in 1896 to $3,816,216, and in 1897 to $4,078,044. It is quite probable that both Sea Island and Egyptian cotton could be cultivated with profit in parts of southern California and southwestern Arizona.

PROFITABLE CROPS FOR DIFFERENT CLIMATES.

But wheat and cotton are not the only crops to be grown with advantage in the South, for the list of fruits, fiber plants, and other agricultural products fit for the climatic conditions of the Austroriparian belt is a long one, and a wise selection with reference to home consumption and convenient markets is bound to place agriculture in the Southern States on a very different plane from that which it now occupies.

In northern New York and Wisconsin[1] the dairying industry is one of the chief sources of revenue, and cheese is a staple product. In years like the present, when cheese sells at the factory for 8 or 9 cents—and still worse a few years ago, when it sold for 4 cents—the farmer is left at the end of the season without return for his labor. Yet, most of the lands now devoted almost exclusively to dairying are situated in the sugar-beet belt, and are also adapted to several excellent varieties of wheat and other crops to which little or no attention is now given.

WHAT THE FARMER NEEDS TO KNOW.

The farmers of the United States spend vast sums of money each year in trying to find out whether a particular fruit, vegetable, or cereal will or will not thrive in localities where it has not been tested. Most of these experiments result in disappointment and pecuniary loss. It makes little difference whether the crop experimented with comes from the remotest parts of the earth or from a neighboring State, the result is essentially the same, for the main cost is the labor of cultivation and the use of the land. If the crop happens to be one that requires a period of years for the test, the loss from its failure is proportionately great.

The cause of failure in the great majority of cases is climatic unfitness. The quantity, distribution, or interrelation of heat and moisture may be at fault. Thus, while the total quantity of heat may be adequate, the moisture may be inadequate, or the moisture may be adequate and the heat inadequate, or the quantities of heat and moisture may be too great or too small with respect to one another or to the time of year, and so on. What the farmer wants to know is *how to tell in advance* whether the climatic conditions on his own farm are fit or unfit for the particular crop he has in view, and what crops he can raise with reasonable certainty. It requires no argument to show that the answers to these questions would be worth in the aggregate hundreds of thousands of dollars yearly to the American farmer. The Biological Survey aims to furnish these answers.

MAPPING AGRICULTURAL REGIONS.

From the study of the geographic distribution of our native animals and plants it has been learned that the United States may be divided into seven transcontinental belts and a number of minor areas, each of which is adapted to particular associations of animal and vegetable life. It has been found also that each of these belts and minor areas, except the coldest, is adapted to the needs of particular agricultural products,

[1] In 1890 New York produced 48.3 per cent and Wisconsin 21.3 per cent of the total output of cheese for the country. The New York output in that year was 124,086,524 pounds.

and that the distribution of native animals and plants may be coordinated with the successful distribution of cultivated crops. In other words, the study of the geographic distribution of our native or indigenous fauna and flora has resulted in the establishment of a number of agricultural belts, each of which comprises several minor divisions fit for particular varieties of fruits, cereals, and breeds of live stock.

Through the intelligent efforts of man the slow processes of nature have been hastened, so that most fruits and cereals have been made to yield varieties adapted to a diversity of climatic conditions. The happy outcome of this artificial selection is that, while certain varieties of wheat, oats, corn, apples, pears, grapes, and so on, thrive only in certain limited areas, different varieties thrive in other areas, a very large proportion of crops having varieties fit for each of the natural agricultural belts of the country. The same is true, though perhaps in less degree, of poultry and live stock.

The Biological Survey is engaged in tracing with as much precision as possible the actual boundaries of these belts and areas, in preparing lists of the native or indigenous species, and of the fruits, grains, vegetables, and other agricultural products that are adapted to each. In this undertaking it aims to point out such exotic agricultural and horticultural products as, from their importance in other lands, are likely to prove of value if introduced on fit soils and under proper climatic conditions. In view of the fact that all of the climatic life zones of the world, except the hottest tropical, are represented in our own country, there can be little doubt that an intelligent study of the agricultural products and adaptations of distant lands will result in the discovery of fruits, vegetables, fibers, farm crops, and breeds of stock which may be introduced into the United States not only with profit, but which by diversifying our products and leading to the development of new industries will render our agricultural resources far more stable and certain.

The colored maps prepared by the Biological Survey furnish the first rational basis the American farmer and fruit grower has ever had for the intelligent distribution of seeds and the only reliable guide he can find in ascertaining beforehand what crops and fruits are likely to prove successful on his own farm, wherever it may be located. These maps, in connection with the work of the Entomologist, show also the belts along which noxious insects are likely to spread, forewarning the husbandman of impending danger.

In studying crops with relation to the zones or areas in which they may be most profitably cultivated considerable progress has been made. The results of an investigation of the zone adaptations of several hundred varieties of fruits and nuts form a part of the present report, and by cooperation with Prof. C. S. Plumb, director of the agricultural experiment station at Lafayette, Ind., the more important results of a similar study of the varieties of corn, wheat, and oats are also given.

DEVELOPMENT OF AGRICULTURE IN CALIFORNIA.

The history of the development of agriculture in California affords an excellent example of the changes in staple products that come with increased knowledge as to the fitness of particular areas for particular crops. In the early days California was distinctly a grazing State, and hides and wool were the chief exports. Then wheat came to the front, and soon formed the staple product. Later it was learned that large areas were particularly well suited to the needs of fruits, and the fruit industry rapidly grew, until at the present time it exceeds even the wheat crop in money value. But the fruits from which so large a revenue is now derived are only in part those first introduced. Fifteen years ago wine grapes were perhaps the most important fruit; now they are of secondary consequence. For a time deciduous fruits were the principal ones deemed worthy of attention; now citrus fruits are of even greater value, the output of oranges and lemons in 1896 being 3,780,000 boxes. Almonds, walnuts, olives, and raisins have also come to be important crops. Twenty-five years ago all our raisins were imported; now California produces annually from 90,000,000 to 100,000,000 pounds.

The development of the prune industry is instructive as an illustration of a common class of cases where products worth hundreds of thousands of dollars annually to a single State have been introduced by chance rather than as a result of scientific study. The first prune cuttings are said to have been brought from France, along with cuttings of grapes and other fruits, by a Frenchman who settled at San Jose about the end of 1856. For some years little was thought of this introduction, and it was not until 1880 and 1881 that serious attention was given the cultivation of prunes. But from 1893 until the present year the annual output in dry fruit has ranged from 44,780,000 to 64,500,000 pounds.[1]

It is hard to resist the temptation to dwell on the marvelous expansion of the fruit industry that has taken place in California since the climatic adaptations of her various agricultural belts began to be understood; but for present purposes a statement of the exports of a few of her many products for the year 1895 will suffice to give a fair idea of the magnitude this industry has attained. In 1895 California shipped 6,625 carloads of fresh deciduous fruits; dried fruits, 6,132 carloads; raisins, 4,638 carloads; canned fruits, 3,129 carloads; citrus fruits (mainly oranges), 11,582 carloads;[2] nuts, 1,333 carloads; wine and brandy, 8,056 carloads.[3]

[1] Statistics from California Fruit Grower.

[2] Figures from Fifth Biennial Rept. California State Board of Agriculture, 1896.

[3] From California State Board of Trade.

THE ARID REGIONS.

While considerable progress has been made in ascertaining what agricultural products are adapted to the climatic conditions of southern California and southern Arizona, this has been done at great cost, and nothing like a complete knowledge of the subject has been attained. Before this will be possible the life zones and their subdivisions must be accurately mapped and corresponding arid areas in Africa, Arabia, Persia, India, Chile, and Australia must be studied with reference to agricultural productions which might be introduced with profit in proper zones in our arid Southwest. Nature has not been overgenerous in the distribution of water in this part of our country, but she has been lavish in her gifts of soils and climates. The fruit growers of California were long in finding out that their State comprises all of the agricultural belts of America except the humid tropical, and that its different areas are naturally adapted to a great diversity of agricultural and horticultural products; and even at the present day few realize that in the southern half of the State hundreds of farms might be so laid out with reference to the mountain slopes that each would embrace sections of all the agricultural belts, enabling the fortunate husbandman to produce not only early and late ripenings of small fruits and garden vegetables, but also an astounding diversity of crops, from the apples, cherries, potatoes, and hardy cereals of the upper Transition and lower edge of the Boreal belts, to the oranges, lemons, almonds, olives, and cotton of the Lower Sonoran zone, and in certain localities the pineapple, date, and citron of the arid Tropical areas. It is probably not too much to say that an accurate map of the agricultural belts of California in the early days would have saved the State in the aggregate millions of dollars that have been expended in finding out what crops are best adapted to particular areas, and although much has now been learned by persistent and costly experiments, such a map would still be of very great value.

SPECIAL VALUE OF NARROW EXTENSIONS OF FAUNAS.

In looking at the map of the life zones (see frontispiece), it will be seen that nearly all of the belts and areas send out long arms which penetrate far into the heart of adjoining areas. When such arms occupy suitable soils in thickly inhabited regions, so that their products may be conveniently marketed, they are of more than ordinary value, for the greater the distance from its area of principal production a crop can be made to succeed, the higher price it will command. Hence, farms favorably situated in northern prolongations or islands of southern zones, or in southern prolongations or islands of northern zones, should be worth considerably more per acre than those situated within normal parts of the same zones. The obvious reason is that

by growing particular crops at points remote from the usual sources of supply, and at the same time conveniently near a market, the cost of transportation is greatly reduced and the profit correspondingly increased.

Among the numerous faunal arms which penetrate adjacent belts are the Hudson, central New York, and Michigan extensions of the Carolinian fauna, and the arms of the Lower Sonoran fauna which occupy the valleys of the Pecos and Rio Grande in New Mexico and the valley of the Lower Virgin in Utah. The latter is a good case for illustration. It is not only the sole Lower Sonoran area in Utah, but lies nearly 300 miles in a straight line, and a little more than 1,000 miles by railroad, from the nearest point where similar crops and fruits are commercially produced. It is an insular pocket or basin, completely hemmed in by mountains, and marks the extreme northeastern extension of the typical Sonoran desert fauna and flora. The creosote bush, mesquite, desert willow, Gregg acacia, and other Sonoran shrubs, and the Gambel quail, Le Conte and crissal thrashers, mocking bird, cactus wren, yellow-headed tit, Abert chewink, black phainopepla, vermilion flycatcher, and Texas nighthawk serve as a guide to its faunal position. The valley is traversed by the Virgin River and its tributary, the Santa Clara, which, together with copious springs, afford water for irrigation. It contains the Mormon settlements St. George, Santa Clara, Toquerville, and a few others of smaller size, with an aggregate population of about 3,000. Among the important products are cotton, tobacco, raisin grapes, almonds, olives, and figs; and among the ornamental shade trees are the pepper tree, tobacco tree, and China tree or Pride of India. The fertility of the soil is marked and the limit of its agricultural capacity, measured either by number of varieties or quantity of output, is still far in the future. Nevertheless, present production greatly exceeds the possibilities of local consumption, as shown by the cotton crop, which, for the year 1896–97, was no less than 123 bales of 500 pounds each, and was worth $4,305.[1] A feature of special interest in relation to the future possibilities of the valley is the fact that the yield of cotton per acre is very much higher than in any other State of the Union, and more than double that of the Gulf States. What is true of cotton is true in greater or less degree of fruits and other crops. There can be little question, therefore, that when railroad connection with northern Utah is established, the St. George Valley is bound to play an important part in the history and commercial prosperity of the young State.

The case of this remote valley brings into prominence the necessity for studying a much neglected subject, and one on which profitable

[1] Statistics from John Hyde, Statistician, Dept. of Agric., in Circ. 8, Div. of Statistics.

agriculture very largely depends. It is not enough to succeed in growing crops well adapted to a particular locality, for bountiful crops are of little value unless they can be profitably marketed. But in order to reach the best markets it is necessary to ascertain the prices various products bring from year to year in different parts of the country, to make quantitative studies of production and consumption, to avoid overproduction, to study statistics of our imports and exports, and give thoughtful attention to questions of transportation; in short, to study commercial geography, at least so far as it relates to the products of one's own farm.

The number and value of the exotic crops now grown successfully in the United States, swelling our revenue by many millions of dollars, is a monument to the industry, perseverance, and determination of the American people, but affords little clue to the multitude of failures and the enormous sums of money lost in experimentation. And it must be admitted that a very large proportion of these costly experiments have been conducted blindly, or at least without the aid of the scientific knowledge so necessary to success. As Professor Hilgard states in a recent report, "the farmer is left to his own devices to find his way as best he may; and we grope along laboriously gathering driblets of information here and there, and gradually, tentatively putting them together into a more or less connected whole." It is not so with other industries. Railroad corporations planning new lines study topographic maps and employ skilled engineers that they may ascertain the most feasible routes; capitalists having in view the purchase of mining properties employ experienced mineral experts that they may learn the direction, extent, and value of the mineral-bearing rocks; manufacturers employ not only skilled artisans, but also expert machinists, chemists, and electrical engineers that their apparatus and methods may yield the fullest returns. But the farmer in his struggle with the soil has none of these resources, and as a rule has little capital to risk in experiments.

The Biological Survey aims to assist him by laying before him maps of the agricultural belts and their subdivisions, with lists of the crops suited to each. These maps, studied with reference to the commercial availability of the different agricultural areas, including the various arms or extensions of the life zones, and with due respect to the density of population and facilities for transportation, are believed to contain much that will be found useful to the progressive student of agriculture.

PART II.

LIFE ZONES OF THE UNITED STATES: BOUNDARIES, NATIVE SPECIES, AND IMPORTANT CROPS.

The continent of North America may be divided, according to the distribution of its animals and plants, into three primary transcontinental regions—Boreal, Austral, and Tropical.

The *Boreal region* (colored green on the map) covers the whole of the northern part of the continent, from the polar sea southward to near the northern boundary of the United States, and farther south occupies a narrow strip along the Pacific coast and the higher parts of the three great mountain systems, the Sierra-Cascade Range, the Rocky Mountains, and the Alleghanies.

The *Austral region* (colored blue, yellow, and brown on the map) covers the whole of the United States and Mexico except the Boreal mountains and Tropical lowlands.

The *Tropical region* (colored red on the map) covers the southern part of the peninsula of Florida, the greater part of Central America, the lowlands of southern Mexico south of the table-land, and a narrow strip on each side of Mexico, which follows the coast northward into the United States.

The fauna and flora within each of these three great regions are not homogeneous, but present marked differences, which have led to the subdivision of each region into a number of minor belts or areas, characterized by particular associations of animals and plants. Thus, the *Boreal region* is divided into three transcontinental belts or zones, known respectively as the Arctic, Hudsonian, and Canadian; the *Austral region*, into three transcontinental belts, known as the Transition, Upper Austral, and Lower Austral. The *Tropical region* is likewise divisible, but the tropical areas within the United States are of such small extent that the divisions need not be here considered. Hence, in North America north of southern Mexico, the total number of transcontinental life zones is seven, of which three are Boreal, three Austral, and one Tropical. Beginning at the north, these zones may be described as follows:

1. THE ARCTIC-ALPINE ZONE.

The Arctic or Arctic-Alpine zone lies above the limit of tree growth and is characterized by such plants as the arctic poppy, dwarf willow, and various saxifrages and gentians. In the far north the snow bunting, snowy owl, ptarmigan, polar bear, arctic fox, polar hare, lemmings,

musk ox, and barren-ground caribou or reindeer, are characteristic animals. Within the United States the Arctic-Alpine zone is restricted to the area above timber-line on the summits of high mountains. It is inhabited by arctic-alpine plants and animals, and is far too cold for agriculture.

2. THE HUDSONIAN ZONE.

The Hudsonian zone comprises the northern part of the great transcontinental coniferous forest—a forest of spruces and firs stretching from Labrador to Alaska—and the upper timbered slopes of the higher mountains of the United States and Mexico. In the north it is inhabited by the wolverine, woodland caribou, moose, rough-legged hawk, great gray owl, great northern shrike, pine bullfinch, white-winged crossbill, white-crowned sparrow, and fox sparrow. In the eastern United States the Hudsonian zone is restricted to the cold summits of the highest mountains, where it occurs in the form of a chain of widely separated islands reaching from northern New England to western North Carolina. In the western United States it covers the higher slopes of the Rocky Mountains and the Sierra-Cascade system, and is the home of the mountain goat, mountain sheep, coney or pika, alpine flying squirrel, Clark's crow or nutcracker, evening grosbeak, and Townsend's solitaire. Like the preceding, this zone is of no agricultural importance.

3. THE CANADIAN ZONE.

The Canadian zone comprises the southern part of the great transcontinental coniferous forest of Canada, the northern parts of Maine, New Hampshire, and Michigan, a strip along the Pacific coast reaching as far south at least as Cape Mendocino in California, and the greater part of the high mountains of the United States and Mexico. In the East it covers the Green Mountains, Adirondacks, and Catskills, and the higher mountains of Pennsylvania, West Virginia, Virginia, western North Carolina, and eastern Tennessee. In the mountains of the West it covers the lower slopes in the north and the higher slopes in the south. In the Rocky Mountain region it appears to reach continuously from British Columbia to west central Wyoming; and in the Cascade Range, from British Columbia to southern Oregon, with a narrow interruption along the Columbia River. Among the many characteristic mammals and birds of the Canadian zone are the lynx, marten, porcupine, northern red and pine squirrels, varying and snowshoe rabbits, star nose, Brewer's and Gibb's moles, water shrew, voles, and long-tailed shrews of various species, northern jumping mice, Belding's and Kennicott's ground squirrels, white-throated sparrow, Blackburnian, yellow-rumped, and Audubon's warblers, olive-backed thrush, three-toed woodpeckers, spruce and dusky grouse, crossbills, and Canada jays. Counting from the north, this zone is the first of any agricultural importance. Wild berries—as currants, huckleber-

ries, blackberries, and cranberries—grow in profusion, and the beechnut (in the East) is an important food of the native birds and mammals. In favored spots, particularly along the southern border, white potatoes, turnips, beets, and the more hardy Russian apples and cereals may be cultivated with moderate success.

4. THE TRANSITION ZONE.

The Transition zone (colored blue on the map) is the transcontinental belt in which Boreal and Austral elements overlap. From New England to the northern Rocky Mountains its course is fairly even and regular, but west of the Great Plains it is tortuous and irregular (see map). The zone as a whole is characterized by comparatively few distinctive animals and plants, but rather by the occurrence together of southern species which here find their northern limit and northern species which here find their southern limit. It may be subdivided into three faunal areas, which, although grading into one another, are in the main strikingly different: (*a*) An eastern humid or *Alleghanian area;* (*b*) a *western arid area;* (*c*) a *Pacific coast humid area.* In the Transition zone we enter from the north the true agricultural part of our country, where many vegetables, the sugar beet, chicory, oats, and numerous varieties of apples, plums, cherries, pears, grapes, white potatoes, and cereals attain their highest perfection. These will be considered more in detail under the subdivisions of the zone.

(*a*) The Alleghanian Faunal Area.

The eastern humid or *Alleghanian* area comprises the greater part of New England, southeastern Ontario, New York, Pennsylvania, Michigan, Wisconsin, Minnesota, eastern North Dakota, northeastern South Dakota, and the Alleghanies from Pennsylvania to Georgia. Its fauna and flora are not homogeneous, but point to an important subdivision west of Lake Michigan, where numerous species occur that do not inhabit the area east of this lake. A glance at the accompanying list of apples, where a cross in front of the variety indicates its absence from Wisconsin and Minnesota, may be taken as an index to the horticultural importance of this Upper Mississippi subdivision. In the Alleghanian faunal area the chestnut, walnut, oaks, and hickories of the South meet and overlap the beech, birch, hemlock, and sugar maple of the North; the Southern mole and cottontail rabbit meet the Northern star-nosed and Brewer's moles and varying hare, and the Southern bobwhite, Baltimore oriole, bluebird, catbird, chewink, thrasher, and wood thrush live in or near the haunts of the bobolink, solitary vireo, and the hermit and Wilson's thrushes. Several native nuts, of which the beechnut, butternut, chestnut, hazelnut, hickory nut, and walnut are most important, grow wild in this belt. Of these,

the chestnut, hickory nut, and walnut come in from the South (Carolinian area) and do not extend much beyond the southern or warmer parts of the Alleghanian area.

Crops of the Alleghanian Faunal Area.

Varieties prefixed by a cross (+) do not thrive in the Upper Mississippi section of the Transition zone (Wisconsin, Minnesota, and the eastern Dakotas), except in eastern Wisconsin in the vicinity of Green Bay. Those followed by the letters (*n*) or (*s*) in this and the following lists are practically restricted, respectively, to the northern or southern parts of the areas under consideration. Similarly the letter (*h*) indicates that the variety is confined to the hottest parts of the zone and belongs more properly to the zone below. Credit is due to Mr. William A. Taylor for marking the fruits in accordance with this plan. The numerals (*2*) and (*3*) indicate that the cereals thus marked are second or third rate in the area under consideration.

CEREALS.

Wheat.

Australian (*3*).
+Clawson.
Fultz (*3*).
Ladoga.
Red Fife.
Saskatchewan Fife.
Scotch Fife.

Oats.

+American Banner.
Black Tartarian.
Lincoln.
Welcome.
White Russian.

Corn.

Angel of Midnight.
+Canadian Eight-Row Yellow Flint.
King Philip.
Longfellow.
Pride of the North.
Squaw (*2*).
Stowell Evergreen (*2* and local).

Barley.

Rye.

Buckwheat.

FRUITS.[1]

Apples.

Alexander.
+Bailey *Sweet* (*s*).
+Baker.
+Baldwin.
+Benoni (*s*).
+Bietigheimer (*s*).
+Blenheim.
+Blue Pearmain.

[1] The nomenclature of fruits is that adopted by the American Pomological Society (Bull. 6, Div. Pomology, U. S. Dept. Agriculture, 1897). Synonyms (indicated by parenthesis) and all descriptive terms which will be eliminated eventually, are printed in italics. A comma indicates a transposition of part of the name.

FRUITS—continued.

Apples—Continued.

+Bullock (*American Golden Russet*).
+Canada Reinette.
+Chenango (*s*).
+Clyde *Beauty*.
+Cogswell (*s*).
+Danvers (*s*).
+Domine (*s*).
+Dutch Mignonne (*s*).
+Dyer (*Pomme Royal*) (*s*).
+Early Harvest.
+Early Ripe (*s*).
+Early Strawberry (*s*).
+Esopus *Spitzenburg*.
+Ewalt (*s*).
+Fall Pippin.
+Fameuse.
+Garden Royal.
+Golden Russet.
+Golden Russet (N. Y.) (*s*).
+Golden Sweet.
+Gravenstein.
+Green Sweet.
Haas (*Fall Queen*) [Mississippi Valley].
+Hightop *Sweet*.
+Hubbardston.
+Hunt *Russet*.
+Jefferis (*s*).
+Jefferson County.
+Jewett *Red*.
+Jonathan (*s*).
+Keswick (*s*).
Longfield.
+Lowell (*s*).
+McIntosh.
McMahon.
+Maiden Blush (*s*).
+Margaret, *Early Red* (*s*).
+Melon, *Norton* (*s*).
+Minister.
+Montreal Peach.
+Moore Sweet (*s*).
+Mother (*s*).
+Newtown Spitzenburg (*s*).
+Northern Spy.
+Ohio Nonpareil (*s*).
Oldenburg, *Duchess of*.
+Ontario.
+Peck *Pleasant*.
+Perry Russet.
Pewaukee.
+Pomme Gris.
+Porter (*s*).
+Primate (*s*).
+Pumpkin Sweet (*Pound Sweet*).
+Rambo (*s*).
+Red Astrachan.
+Red Canada.
+Rhode Island *Greening*.
+Ribston.
+Rolfe.
Roman Stem.
+Roxbury.
+Saint Lawrence.
+Scott Winter.
+Shiawassee.
+Sops of Wine.
+Sterling (*American Beauty*).
+Summer Pearmain (*s*).
+Sutton.
+Swaar (*s*).
Tetofski.
+Tolman *Sweet*.
+Tompkins King.
+Twenty-Ounce.
+Vandevere (*s*).
+Wagener.
Wealthy.
Westfield.
+Williams *Favorite*.
+Wine, *Hays* (*s*).
Wolf *River*.
Yellow Transparent.

Crab apples.

Beach.
Brier.
+Elgin.
Excelsior.
Gibb.
+Hyslop.
Martha.
Marengo.
Minnesota.
Montreal.
Orange.
Red Siberian.
Transcendent.
+Van Wyck.
Whitney *No. 20*.
Yellow Siberian.

FRUITS—continued.

Cherries.

+Archduke.
Bessarabian.
+Black Heart (*s*).
+Buttner, *Yellow* (*s*).
+Choisy, *Belle de.*
+Coe *Transparent* (*s*).
+Donna Maria (*s*).
+Downer (*s*).
+Dyehouse (*s*).
+Eagle, *Black* (*s*).
+Early Purple *Guigne* (*s*).
+Elton (*s*).
+Eugenie, *Empress* (*s*).
+Florence (*s*).
+Hortense, *Reine* (*s*).
+Hovey (*s*).
Late Kentish.
Lutovka.
+Magnifique, *Belle* (*s*).
+Mayduke (*s*).
+Montmorency Large.
+Montmorency Ordinaire.
Morello, *English.*
+Napoleon (*s*).
+Olivet (*s*).
+Philippe, *Louis* (*s*).
+Plumstone Morello (*s*).
Richmond.
+Tartarian, *Black.*
+Windsor.
+Wood, *Governor.*

Cranberries.

Currants.

Albert, *Prince.*
+Cherry.
+Fay *Prolific* (*s*).
Holland, *Long Bunch.*
+London *Red* (*s*).
Red Dutch.
+Red Grape.
+Versaillaise.
Victoria.
White Dutch.
White Grape.

Black currants.

Champion (*s*).
English (*s*).
Naples (*s*).
+Wales, *Prince of* (*s*).

Grapes.

Agawam.
+Barry.
Brighton.
Champion.
Clinton.
Concord.
Cottage.
+Diana.
Lindley.
+Martha.
Moore *Early.*
+Salem.
Vergennes.
Victor, *Early.*
+Wilder.
Winchell (*Green Mountain*).
Worden.

Pears.

+Andrews.
+Angouleme, *Duchess de* (*s*).
+Anjou (*s*).
+Bartlett (*s*).
+Bosc (*s*).
+Boussock (*s*).
+Brandywine (*s*).
+Buffum.
+Clairgeau (*s*).
+Clapp *Favorite* (*s*).
+Columbia (*s*).
+Dana Hovey (*s*).
+Diel.
+Dix.
+Elizabeth, *Manning.*
+Flemish *Beauty.*
+Fulton.
+Giffard (*s*).
+Goodale.
+Howell (*s*).

FRUITS—continued.

Pears—Continued.

+Julienne (*s*).
+Lawrence (*s*).
+Louise *Bonne de Jersey*.
+Lucrative (*s*).
+McLaughlin.
+Madeleine (*s*).
+Malines, *Josephine de* (*s*).
+Onondaga (*s*).
+Osband *Summer* (*s*).
+Pound.
+Rostiezer (*s*).
+Seckel (*s*).
+Sheldon (*s*).
+Souvenir *du Congress* (*s*).
+Sterling.
+Summer Doyenne (*s*).
+Tyson.

Plums.

+Arctic, *Moore*.
Aubert, *Yellow*.
+Bavay *Green Gage*.
De Soto.
+Diamond, *Black* (*s*).
Downing, *Charles*.
+Drap d'Or (*s*).
+Duane *Purple* (*s*).
+Englebert (*s*).
Forest *Garden*.
+German Prune (*s*).
+Golden Drop, *Coe* (*s*).
+Grand Duke (*s*).
Green Gage.
+Hudson *River Purple Egg* (*s*).
+Hulings *Superb* (*s*).
+Imperial Gage (*s*).
+Jefferson (*s*).
+Kingston (*s*).
+Lawrence *Favorite* (*s*).
Lombard.
+McLaughlin.
Moldavka.
+Monroe *Egg* (*s*).
+Orleans (*s*).
+Ottoman (*s*).
+Pond (*Hungarian Prune*).
+Purple Gage (*s*).
+Quackenboss (*s*).
Richland.
Rollingstone.
+Shropshire (*s*).
+Smith Orleans (*s*).
+Transparent *Gage* (*s*).
+Wales, *Prince of* (*s*).
+Wangenheim (*s*).
+Washington (*s*).
Weaver.
Wolf.
Wyant.
Yellow Egg.

Quinces.

Orange (*Apple*) (*s*).

Strawberries.

Bubach *No. 5*.
Crescent.
Cumberland.
Downing, *Charles*.
Eureka (*s*).
Haverland.
Jessie.
Michel *Early* (*s*).
Miner.
Princess.
Sharpless.
Warfield.
Wilson.

MISCELLANEOUS.

Flax (*s*).
Hops.
Maple sugar.
Sorghum (*s*).
Sugar beet.
Sweet corn.
White potatoes.

(*b*) The Arid Transition Faunal Area.

The western or arid division of the Transition zone comprises the western part of the Dakotas, northern Montana east of the Rocky Mountains, southern Assiniboia, small areas in southern Manitoba and Alberta, the higher parts of the Great Basin and the plateau region generally (except the Boreal Mountains), the eastern base of the Cascade-Sierra system, and local areas still farther west, in Oregon and California, where it merges into the humid Pacific Coast division.

In the western arid Transition area the true sage brush (*Artemisia tridentata*) is the prevailing type of vegetation, although extensive tracts are covered with noble forests of the yellow or bull pine (*Pinus ponderosa*) and subspecies.[1] The sage hen and sharp-tailed grouse, green-tailed towhee, white-tailed jackrabbit (*Lepus campestris*), pallid voles (subgenus *Lagurus*), and certain ground squirrels are characteristic species. In the northern parts of the Great Basin (northern and eastern Washington, northeastern Oregon, and northwestern Idaho) the large Columbia or Lewis and Clark ground squirrel (*Spermophilus columbianus*) is common in the Transition zone, whence it ranges northward into the Boreal. East of the Rocky Mountains, on the northern plains (in North Dakota, northern Montana, and parts of Assiniboia and Manitoba), it is replaced by a very different species (*S. richardsoni*), which resembles a small prairie dog (*Cynomys*) so closely that it is often mistaken for that animal.

Crops of the Arid Transition Faunal Area.

[Lists very incomplete.]

CEREALS.

Wheat.

Ladoga.	Saskatchewan Fife (*2*).
Red Fife.	Scotch Fife.

Oats.

American Banner.	Welcome.
Black Tartarian.	White Russian.
Lincoln.	

Corn.

Angel of Midnight (*2*).	Longfellow (*2*).
Canadian Eight-Row Yellow Flint (*2*).	Squaw.
King Philip (*2*).	Stowell Evergreen (*2*).

[1] Among the distinctive humbler plants which recur throughout the pine belt from Arizona to Oregon two small shrubs, *Berberis repens* and *Ceanothus fendleri*, are conspicuous. *Gilia aggregata*, a small plant with handsome red flowers, is also common in this belt.

CEREALS—continued.

Barley.

Rye.

Buckwheat.

FRUITS.[1]

Apples.

Alexander.
Baldwin.
Dutch Mignonne.
Dyer (*Pomme Royal*).
Early Harvest.
Early Strawberry.
Esopus *Spitzenburg.*
Fameuse.
Golden Russet.
Golden Sweet.
Gravenstein.
Hightop *Sweet.*
Hubbardston.
Jefferis.
Jonathan.
Keswick.
Longfield.
Lowell.
Maiden Blush.
Monmouth.
Mother.
Newtown Spitzenburg.
Northern Spy.
Oldenburg, *Duchess of.*
Pewaukee.
Porter.
Primate.
Rambo.
Red Astrachan.
Rhode Island *Greening.*
Roman Stem.
Rome Beauty.
Roxbury.
Sops of Wine.
Summer Pearmain.
Swaar.
Tetofski.
Tolman *Sweet.*
Tompkins King.
Twenty-Ounce.
Wagener.
Wealthy.
Westfield.
Williams *Favorite.*
Wine, *Hays.*
Winesap. (?)
Wolf *River.*
Yellow Newtown *Pippin.*
Yellow Transparent.

Cherries.

Archduke.
Choisy, *Belle de.*
Ostheimer *Weichsel.*

Grapes.

Wilder.
Worden.

Pears.

Angouleme, *Duchess de*
Anjou.
Bartlett.
Bosc.
Boussock.
Brandywine.
Clairgeau.
Clapp *Favorite.*
Columbia.
Easter *Beurre.*
Flemish *Beauty.*
Lawrence.
Lucrative.
Onondaga.
Osband *Summer.*
Seckel.
Tyson.
Winter Nelis.

[1] At the present time the culture of fruits enumerated under the Arid Transition faunal area is confined largely to western Montana, Idaho, eastern Washington, eastern Oregon, and parts of Utah.

FRUITS—continued.

Plums.

De Soto. Forest *Garden.*

Strawberries.

Bubach *No. 5.* Jessie.
Captain Jack.

MISCELLANEOUS.

White potatoes.

Flax.

Sugar beet.

(*c*) The Pacific Coast Transition Faunal Area.

The humid Pacific Coast division of the Transition zone comprises the western parts of Washington and Oregon between the coast mountains and the Cascade Range, parts of northern California, and most of the coast region of California from near Cape Mendocino southward to the Santa Barbara Mountains. To the south and east it passes into the Arid Transition, and in places into the Upper Sonoran.

In the *Pacific Transition area* unusual conditions prevail. The region as a whole is one of great humidity, and in places on the northwest coast the annual rainfall reaches 100 inches. The northern and more humid part is covered by a magnificent coniferous forest, carpeted with moss and ferns, and often choked with undergrowth. The prevailing trees are Douglas fir, Pacific cedar, Western hemlock, and Sitka spruce, whose majestic trunks attain an average height of more than 200 feet. There are also many broad-leaf maples, tree alders, madroñas and Western dogwoods, and numerous kinds of shrubs,[1] a goodly proportion of which aspire to the size of small trees. Among the birds which inhabit these forests are the dark Pacific Coast forms of the great-horned, spotted, screech, and pigmy owls, the sooty grouse and handsome Oregon ruffed grouse, Steller's jay, the chestnut-backed chickadee, and the Pacific winter wren. Among the mammals are the Columbia black-tail deer, Western raccoon, Oregon spotted skunk, Douglas red squirrel, Townsend's chipmunk, peculiar species of pocket gophers and voles, the curious Gibb's mole, and the remarkable tailless sewellel (*Aplodontia rufa*).

In the Puget Sound region and most of the cultivated parts of western Washington the annual rainfall is 50 to 60 inches; in western Oregon it is still less, decreasing in the Willamette, Umpqua, and Rogue River valleys from about 50 to less than 30 inches.[2] In the

[1] Among the small shrubs perhaps none are more characteristic and widespread than the salal (*Gaultheria shallon*), thimble berry (*Rubus nootkanus*), salmon berry (*Rubus spectabilis*), Oregon grape (*Berberis nervosa*), and in wet places the devil's club (*Echinopanax horridum*).

[2] Rainfall of the Pacific Slope and the Western States and Territories, by Gen. A. W. Greely, Chief Signal Officer, and Lieut. W. A. Glassford, assistant, 1888.

last-mentioned valleys the summer rainfall (May to September) is less than 5 inches, while in western Washington (not including the coast or mountains) it varies from 5 to 10 inches. The region as a whole is one of relatively uniform temperature, the wide seasonal differences usual in other parts of the Transition zone being unknown. The temperature of the summer season, the hottest part of the year, is phenomenally low for the latitude, enabling northern or Boreal types to push south as far as latitude 35°. On the other hand, the summer season is so prolonged (from the standpoint of temperature) that the total quantity of heat for the entire season is phenomenally high for the latitude, enabling southern or Austral species to push north as far as Puget Sound, where the total quantity of heat is even greater than at Philadelphia, Pittsburg, Cleveland, and Omaha, although Puget Sound is 500 miles north of the latitude of these places. Even at Cape Flattery—the extreme northwestern point of the United States—which is exposed throughout the year to the cold coast fogs, the total quantity of heat is 500° F. greater than at Eastport, Me., although the latter is the more southern locality and has the higher mean summer temperature. The low summer temperature along the Pacific Coast permits northern species to come far south, while the high sum total of heat enables southern species to push northward as far as Puget Sound. Such an extensive overlapping of Boreal and Austral faunas does not occur elsewhere in North America, and for the evident reason that no area approaching it in extent has so equable a temperature.

In most parts of the United States it is easy to distinguish the boundaries between the Transition and Upper Austral zones, but in the Pacific Transition area these distinctions are nearly obliterated, a large proportion of the species ranging in common over both belts.

To the southward, particularly away from the coast, where the Pacific Transition area receives less moisture and more summer heat and the seasonal changes of temperature are greater, the faunal relations become more and more complex. The decrease in humidity allows Arid Transition species to creep in, while the increase in total quantity of heat brings with it a marked increase in the number of Upper Sonoran species, so that types ordinarily characteristic of the humid Pacific Transition, the Arid Transition, and the Upper Sonoran occur together.[1] The total quantity of heat in most parts of the Willamette and Rogue River valleys is about 2,000° F. more than in the Puget Sound region, and is as great as on the adjacent plains of the Columbia and slightly greater than at St. Louis, Mo., and Washington, D. C.

These warmer and less humid parts of the Pacific Transition area,

[1] Hood River, at the north base of the Cascade Range in Oregon, is situated in the belt of overlapping, where the humid Pacific Transition of the gorge of the Columbia merges into the arid Upper Sonoran of the adjacent Great Basin.

as the Willamette, Umpqua, and Rogue River valleys in Oregon, and numerous small areas in California, are adapted to a much wider range of agricultural products than normal parts of the same zone, and are conspicuous for the large number of Upper Austral fruits which may be cultivated with success. In passing southward from the Puget Sound region this increase in Austral varieties is very marked, but it is poorly indicated in the following list:

CROPS OF THE PACIFIC COAST TRANSITION FAUNAL AREA.

CEREALS.

Wheat.

Red Fife (*2*).

Oats.

American Banner (*2*).
Black Tartarian (*2*).
Lincoln (*2*).
Welcome.
White Russian.

Corn.

King Philip.
Pride of the North (*2*).
Stowell Evergreen (*2*).

Buckwheat.

FRUITS.

Apples.

Baldwin.
Ben Davis (*s*).
Blue Pearmain.
Early Harvest (*s*).
Esopus.
Fall Pippin (*s*).
Gravenstein.
Jonathan (*s*).
Keswick.
Maiden Blush.
Monmouth.
Northern Spy.
Oldenburg, *Duchess of.*
Rambo (*s*).
Red Astrachan.
Red June (*s*).
Rhode Island *Greening.*
Sops of Wine.
Swaar.
Tompkins King.
Wagener.
Wealthy.
Winesap (*s*).
Yellow Bellflower (*s*).
Yellow Newtown *Pippin* (*s*).
Yellow Transparent.

Cherries.

Advance, *California.*
Bing.
Centennial.
Coe *Transparent.*
Elton.
Lewelling (*Black Republican*).
Napoleon (*Royal Ann*).
Richmond (*Kentish*).
Rockport.
Spanish, *Yellow.*
Tartarian, *Black.*
Windsor.
Wood, *Governor.*

Cranberries.

Currants.

Black Naples.
Cherry.
Fay *Prolific.*
Red Dutch.
Victoria.
White Grape.

FRUITS—continued.

Gooseberries.

Grapes.

Concord.
Isabella.
Moore *Early.*

Peaches.

Hale.

Pears.

Bartlett.
Bosc (*s*).
Boussock.
Clairgeau (*s*).
Clapp *Favorite.*
Flemish *Beauty.*
Seckel (*s*).
Tyson (*s*).
Winter Nelis (*s*).

Plums (including prunes).

Agen (*French, Petite,* etc.) (*s*).
Columbia.
Dosch.
German *Prune.*
Golden Drop, *Coe* (*s*).
Golden *Prune* (*s*).
Italian (*Fellenberg*) (*s*).
Pond (*Hungarian Prune*).
Silver *Prune* (*s*).
Tragedy (*s*).
Yellow Egg.

Strawberries.

Bubach, *No. 5.*
Clark *Seedling.*[1]
Crescent.
Everbearing.
Jessie.
Monarch.
Perry.
Sharpless.
Vick.
Wilson *Albany.*

MISCELLANEOUS.

Alfalfa (*s*).
Hops.
Sugar beet (*s*).
Sweet corn.
White potatoes.

5. THE UPPER AUSTRAL ZONE.

The Upper Austral zone (colored yellowish on the map) may be divided into two large and important faunal areas—an eastern humid or *Carolinian area* and a western arid or *Upper Sonoran area*, which pass insensibly into one another in the neighborhood of the one hundredth meridian. They may be described separately.

(*a*) The Carolinian Faunal Area.

The Carolinian faunal area (colored yellowish, spotted with red, on the map) occupies the larger part of the Middle States, except the mountains, covering southeastern South Dakota, eastern Nebraska, Kansas, and part of Oklahoma; nearly the whole of Iowa, Missouri, Illinois, Indiana, Ohio, Maryland, and Delaware; more than half of West Virginia, Kentucky, Tennessee, and New Jersey, and large areas in Alabama, Georgia, the Carolinas, Virginia, Pennsylvania,

[1] Markedly successful at Hood River, Oregon, where the Pacific or humid division of the Transition zone merges into the arid Upper Sonoran.

New York, Michigan, and southern Ontario. On the Atlantic coast it reaches from near the mouth of Chesapeake Bay to southern Connecticut, and sends narrow arms up the valleys of the Connecticut and Hudson rivers. A little farther west another slender arm is sent northward, following the east shore of Lake Michigan nearly or quite to Grand Traverse Bay. These arms, like nearly all narrow northward prolongations of southern zones, do not carry the complete faunas and floras of the areas to which they belong, but lack certain species from the start and become more and more dilute to the northward till it is hard to say where they really end. Their northern boundaries, therefore, must be drawn arbitrarily or must be based on the presence or absence of particular species rather than the usual association of species.

Counting from the north, the Carolinian area is that in which the sassafras, tulip tree, hackberry, sycamore, sweet gum, rose magnolia, red bud, persimmon, and short-leaf pine first make their appearance, together with the opossum, gray fox, fox squirrel, cardinal bird, Carolina wren, tufted tit, gnatcatcher, summer tanager, and yellow-breasted chat. Chestnuts, hickory nuts, hazelnuts, and walnuts grow wild in abundance. The area is of very great agricultural importance.

Crops of the Carolinian Faunal Area.

Cereals do well in the Carolinian area, particularly wheat and corn. The sugar beet is an important crop in the northern parts, but fails to develop sufficient sugar for profitable culture in the southern parts. Fruits thrive almost everywhere, and in great variety, as shown by the following list:

CEREALS.

Wheat.

Clawson.
Fulcaster.
Fultz.
Mediterranean.
Turkey Red [Mississippi Valley].
Velvet Chaff.

Oats.

Lincoln (*2*).
Red Rust Proof.
Welcome.
White Russian (*2*).

Corn.

Bloody Butcher.
Golden Dent (*2*).
Hickory King (*2*).
King Philip (*3*).
Leaming.
St. Charles White [Mississippi Valley] (*2*).
Stowell Evergreen.
White Gourd Seed (*2*).

Barley.

Rye.

Buckwheat (*2*).

FRUITS.

Apples.

Arkansas (*Mammoth Black Twig*).
Bailey *Sweet*.
Baldwin (*n*).
Belmont.
Ben Davis.
Benoni.
Bentley.
Bonum.
Bough, *Sweet*.
Bradford *Best* (*Kentucky Red*).
Broadwell.
Buckingham.
Cannon *Pearmain*.
Champlain (*Nyack*).
Clayton.
Cornell *Fancy*.
Cullasaga.
Domine (*n*).
Dyer (*Pomme Royal*).
Early Cooper.
Early Harvest.
Early Joe.
Early Pennock.
Early Strawberry.
Edward *Early*.
Esopus (*n*).
Evening Party.
Ewalt.
Fallawater.
Fall Orange.
Fall Pippin.
Fall Wine.
Fanny.
Fink.
Fulton.
Gilpin.
Golden Russet (*n*).
Golden Sweet.
Green Cheese.
Green Newtown.
Grimes *Golden*.
Haas (*Fall Queen*).
Hewes *Crab*.
Hightop *Sweet* [Mississippi Valley].
Hoover.
Horse.
Hubbardston (*n*).
Jefferis.
Jersey Sweet.
Jonathan (*n*).
July (*Fourth of July*).
Keswick.
Kinnaird.
Lady.
Lady Sweet.
Lansingburg.
Late Strawberry.
Lawver (*Delaware Red Winter*).
Limber Twig.
Lowell.
McAfee.
McLellan.
Maiden Blush.
Mangum.
Margaret, *Early Red*.
Milam.
Missouri *Pippin*.
Melon, *Norton* (*n*).
Monmouth.
Moore Sweet.
Mother.
Newtown Spitzenburg.
Nickajack.
Northern Spy (*n*).
Ohio Nonpareil.
Oldenburg, *Duchess of*.
Ontario (*n*).
Ortley.
Otoe (*n*).
Perry Russet (*n*).
Porter.
Primate.
Pryor *Red*.
Ralls *Genet*.
Rambo.
Ramsdell *Sweet*.
Red Astrachan.
Red June.
Red Stripe.
Rhode Island *Greening* (*n*).
Romanite, *South*.
Roman Stem.
Rome Beauty.
Shockley.
Smith *Cider*.
Smokehouse.
Sops of Wine (*n*).
Stark (*n*).
Summer Pearmain.
Summer Queen.
Summer Rose.
Sutton (*n*).
Swaar (*n*).
Sweet Winesap.

FRUITS—continued.

Apples—Continued.

Tetofski.
Tompkins King (*n*).
Trenton Early.
Twenty-Ounce (*n*).
Vandevere.
Wagener (*n*).
Walbridge (*Edgar Red Streak*).
Westfield (*n*).
White Juneating.
White Pearmain.
White Pippin.
Willow Twig.
Wine, *Hays* (*n*).
Winesap.
Wythe.
Yellow Bellflower.
Yellow Newtown *Pippin* (*Albemarle*).
Yellow Transparent.
York Imperial.

Crabapples.

Hyslop.
Martha.
Transcendent.
Yellow Siberian.

Apricots.[1]

Alexander [Mississippi Valley].
Breda.
Budd [Mississippi Valley].
Early Golden.
Gibb [Mississippi Valley].
Harris.
Hemskirke.
Large Early.
Moorpark.
Peach.

Cherries.

Archduke (*n*)
Black Heart.
Carnation.
Choisy, *Belle de.*
Coe *Transparent* (*n*).
Downer (*n*).
Dyehouse.
Eagle, *Black.*
Early Purple *Guigne.*
Elton (*n*).
Eugenie, *Empress.*
Hortense, *Reine.*
Knight *Early.*
Late Kentish.
Magnifique, *Belle.*
Mayduke.
Morello, *English.*
Napoleon (*Royal Ann*).
Olivet.
Plumstone Morello.
Richmond (*Kentish*).
Rockport (*n*).
Spanish, *Yellow.*
Tartarian, *Black.*
Windsor (*n*).
Wood, *Governor.*

Cranberries.

[While cranberries are an important crop in parts of New Jersey and a few other States within the general boundaries of the Carolinian fauna, they grow only in cold bogs which have the proper temperature of the Transition or even Boreal zone.]

Grapes.

Agawam (*n*).
Barry (*n*).
Brighton.
Catawba.
Champion.
Clinton (*n*).
Concord.
Cynthiana (*s*).
Delaware.
Diamond (*n*).
Diana (*n*).
Duchess.

[1] Of little account in the Eastern States, because of too early flowering, with consequent danger from frost.

FRUITS—continued.

Grapes—Continued.

Elvira (*s*).
Goethe (*s*).
Iona (*n*).
Isabella.
Ives.
Jefferson.
Lindley.
Missouri Reisling (*s*). ?
Moore *Early*.
Niagara.
Noah [South Mississippi Valley] (*s*).
Norton *Virginia* (*s*).
Pocklington (*n*).
Prentiss (*n*).
Salem.
Telegraph.
Ulster (*n*).
Worden (*n*).
Wyoming.

Peaches.

Alexander.
Beers *Smock*.
Bilyeu.
Chili, *Hills*.
Early Crawford.
Elberta.
Foster.
George IV.
Globe.
Golden Drop.
Grosse Mignonne.
Hale.
Heath *Cling*.
Hoover.
Kenrick *Heath*.
Large York.
Late Admirable.
Late Crawford.
Late Rareripe.
Morris White.
Mountain Rose.
Oldmixon Cling.
Oldmixon Free.
Red Cheek *Melocoton*.
Reeves *Favorite*.
Richmond.
Rivers.
Salway.
Smock.
Sneed.
Stevens *Rareripe*.
Strawberry.
Stump.
St. John, *Yellow*
Susquehanna.

Nectarines.

Boston.
Elruge.
Stanwick.

Pears.

Angouleme, *Duchess de*.
Anjou (*n*).
Bartlett (*n*).
Bloodgood.
Bosc (*n*).
Boussock (*n*).
Brandywine.
Buffum (*n*).
Chambers.
Clairgeau (*n*).
Clapp *Favorite* (*n*).
Columbia.
Comice, *Doyenne du* (*n*).
Diel.
Easter *Beurre*.
Garber.
Giffard.
Gray Doyenne (*n*).
Hosenschenk.
Howell.
Julienne.
Kieffer.
Kirtland (*n*).
Lawrence.
Louise *Bonne de Jersey*.
Lucrative (*n*).
Madeleine (*n*).
Malines, *Josephine de* (*n*).
Marguerite, *Petite* (*n*).
Mount Vernon (*n*).
Napoleon (*n*).
Onondaga (*n*).
Osband *Summer*.
Paradise *d'Automne* (*n*).

FRUITS—continued.

Pears—Continued.

Rostiezer.
Rutter.
Seckel.
Sheldon.
Summer Doyenne.
Superfin (*n*).
Tyson.
White Doyenne (*n*).
Winter Nelis.

Plums.

Abundance.
Agen (*French*, *Petite*, etc.) (*n*).
Archduke (*n*).
Bavay *Green Gage* (*n*).
Bleecker *Gage* (*n*).
Bradshaw (*n*).
Burbank.
Chabot.
Clinton.
Columbia (*n*).
Copper (*n*).
Damson.
Diamond, *Black* (*n*).
Drap d'Or (*n*).
Duane *Purple* (*n*).
Englebert (*n*).
German *Prune* (*n*).
Golden Drop, *Coe.*
Grand Duke (*n*).
Hand (*n*).
Hudson *River Purple Egg* (*n*).
Hulings *Superb* (*n*).
Imperial Gage (*n*).
Italian (*Fellenberg*) (*n*).
Jefferson.
Kerr (*Hattankio 2*).
Kingston (*n*).
Lawrence *Favorite* (*n*).
Lombard.
Miner.
Monroe *Egg* (*n*).
Newman.
Ogon.
Orleans (*n*).
Ottoman (*n*).
Peach (*n*).
Prince *Yellow.*
Purple Favorite (*n*).
Purple Gage (*n*).
Red Nagate.
Richland.
Robinson.
Saratoga (*n*).
Saunders (*n*).
Satsuma.
Shropshire.
Smith Orleans (*n*).
Transparent *Gage* (*n*).
Washington (*n*).
Wales, *Prince of* (*n*).
Wangenheim (*n*).
Wild Goose.
Willard.
Yellow Egg (*n*).

Quinces.

Champion.
Missouri *Mammoth.*
Meech.
Orange (*Apple*).
Rea.

Raspberries.

Strawberries.

Bubach *No. 5.*
Crescent.
Cumberland.
Downing, *Charles.*
Enhance.
Eureka.
Gandy.
Greenville.
Haverland.
Jersey *Queen.*
Jessie.
Michel *Early.*
Miner.
Parker Earle.
Sandoval.
Sharpless.
Warfield.
Wood, *Beder.*

NUTS.

Peanuts[1] *(h).*

MISCELLANEOUS.

Cowpeas.
Flax.
Hemp (Cannabis sativa).
Lima beans.
Sorghum.
Sugar beet.
Sweet potatoes (h).
Tobacco.
White potatoes.

(*b*) The Upper Sonoran Faunal Area.

The Upper Sonoran faunal area (colored yellowish without spots on the map) of the Western States and Territories is the arid-land continuation of the Carolinian area of the more humid Eastern States. Beginning in the neighborhood of the one hundredth meridian, it covers most of the great plains in eastern Montana and Wyoming, southwestern South Dakota, western Nebraska, Kansas, Oklahoma, and Texas, and eastern Colorado and New Mexico. In Oregon and Washington it covers the plains of the Columbia and the Malheur and Harney plains; in California it encircles the Sacramento and San Joaquin valleys and forms a narrow belt along the eastern boundary of the Colorado and Mohave deserts; in Utah it covers the Salt Lake and Sevier deserts; in Idaho the Snake Plains, and in Nevada and Arizona irregular areas of suitable elevation, as will be seen by the map. Except in California, the most conspicuous vegetation of the Upper Sonoran areas is the true sagebrush (*Artemisia tridentata*), which, however, is equally abundant in the Transition zone. Several of the so-called 'greasewoods' (*Atriplex confertifolia*, *A. canescens*, *A. nuttalli*, *Tetradymia canescens*, *Sarcobatus vermiculatus*, and *Grayia spinosa*) are characteristic of suitable soils, and nut pines (piñon) and junipers occur here and there, mostly on the mountain slopes.

Among the characteristic birds and mammals are the burrowing owl, Brewer's sparrow, Nevada sage sparrow, Lazuli finch, sage thrasher, Nuttall's poor-will, Bullock's oriole, rough-winged swallow, five-toed kangaroo rats, pocket mice, grasshopper mice, sage chipmunk, sage cottontail, Idaho rabbit, black-tailed jack rabbit, and the Oregon, Utah, and Townsend's ground squirrels. Some parts of the Upper Sonoran in Oregon, Washington, and Idaho have so hot a climate that they might almost be considered Lower Sonoran. The localities referred to are Alvord Desert in southern Oregon, and certain parts of the valleys of the Snake and Columbia rivers, including the lower part of the canyon of the Des Chutes. While Alvord Desert is a direct continuation of the Sonoran deserts of Nevada, the areas along the Columbia and Snake rivers are completely isolated and widely

[1] Peanuts are not of much commercial importance in this zone, though grown on a small scale locally in Michigan, Nebraska, New Jersey, Delaware, and a few other States.

removed, geographically, from the Lower Sonoran. Nevertheless, hot stretches in these valleys have been reached by the canyon wren (*Catherpes mexicanus conspersus*) and other southern species, and have been found adapted to the needs of a number of Lower Sonoran fruits. Thus, in the Snake River Valley at Lewiston, Idaho, and Almota, Wash., almonds, peanuts, sweet potatoes, and a variety of Lower Austral fruits do as well as several hundred miles farther south. This is well shown by the fact that the Sweetwater; Alexandria, *Muscat of*; Malaga; Peru, *Rose of*; Tokay, *Flame*; Zinfandel; and Thompson *Seedless* grapes thrive in this part of the valley.

Crops of the Upper Sonoran Faunal Area.

The Upper Sonoran area, notwithstanding its aridity, is of considerable agricultural importance. Fruits and cereals succeed wherever water may be had for irrigation, and in the less arid parts wheat, corn, barley, and rye yield their heaviest returns. Kafir corn (a kind of millet) thrives without irrigation, particularly on the great plains, and alfalfa with irrigation matures several crops a year, though not so many as in the Lower Sonoran.

CEREALS.

Wheat.

Australian.
Fultz (*3*).
May wheats (*3*).
Mediterranean (*2*).
Red Fife (*2*).
Sonora.
Turkey Red (*2*).
Velvet Chaff (*3*).

Oats.

Lincoln (*2*).
Red Rust Proof (*2*).
Welcome (*2*).
White Russian (*2*).

Corn.

Hickory King (*3*).
King Philip (*2*).
Leaming (*2*).
Pride of the North (*3*).
Squaw (*3*).

Barley.

Rye.

FRUITS.

Apples.

Alameda, *Beauty of.*
Belmont.
Ben Davis.
Blue Pearmain.
Cook *Seedling.*
Dyer (*Pomme Royal*).
Early Harvest.
Early Pennock.
Early Strawberry.
Esopus *Spitzenburg.*
Fall Jenneting.
Fall Orange.
Fall Pippin.
Fall Wine.
Gloria Mundi.
Golden Russet.
Golden Sweet.
Grimes *Golden.*

FRUITS—continued.

Apples—Continued.

Haas (*Fall Queen*).
Hawthornden.
Hightop *Sweet*.
Holland *Pippin*.
Hubbardston.
Jersey Sweet.
Jonathan.
Keswick.
Lady Sweet.
Lawver (*Delaware Red Winter*)
Limber Twig.
Lowell.
Maiden Blush.
McAfee.
Marshall *Red* (*Red Bellflower*).
Missouri *Pippin*.
Monmouth *Pippin* (*Red Cheek Pippin*).
Mother.
Newtown Spitzenburg.
Nickajack.
Northern Spy.
Oldenburg, *Duchess of*.
Porter.
Primate.
Ralls *Genet*.
Rambo.
Red Astrachan.
Red Canada.
Red June.
Rhode Island *Greening*.
Roman Stem.
Rome Beauty.
Smith *Cider*.
Summer Pearmain.
Summer Queen.
Summer Rose.
Swaar.
Tetofski.
Tompkins King.
Twenty-Ounce.
Wagener.
Wealthy.
Westfield.
White Pearmain.
Wine, *Hays*.
Winesap.
Wolf *River*.
Yellow Bellflower.
Yellow Newtown *Pippin*.

Apricots.

Alexander.
Blenheim.
Breda.
Budd.
Eureka.
Gibbs.
Hemskirke.
Large Early.
Montgamet. *Alberge de*.
Montgamet Early.
Moore Early.
Moorpark.
Newcastle.
Peach.
Pringle.
Royal Golden, *Brier*.
St. Ambroise.
Vestal *Moorpark*.

Cherries.

Archduke.
Bing.
Centennial.
Choisy, *Belle de*.
Cleveland.
Early Purple *Guigne*.
Late Duke.
Lewelling (*Black Republican*).
Mayduke.
Montmorency Large.
Montmorency Ordinaire.
Morello, *English*.
Napoleon (*Royal Ann*).
Olivet.
Ostheimer, *Weichsel*.
Richmond (*Kentish*).
Rockport.
Spanish, *Yellow*.
Tartarian, *Black*.
Thompson *Seedling*.
Windsor.
Wood, *Governor*.

FRUITS—continued.

Grapes.

Agawam.
Alexandria, *Muscat of* (*h*).[1]
Black Ferrara.
Black Hamburgh.
Catawba.
Chasselas, Red.
Chasselas Rose.
Concord.
Delaware.
Elvira.
Emperor (*h*).
Isabella.
Ives.
Malaga (*h*).
Massasoit.
Mission.
Moore *Early*.
Norton *Virginia*.
Pierce (*Isabella Regia*).
Peru, *Rose of* (*h*).
Prince, *Black*.
Royal Muscatine (*h*).
Salem.
Sweetwater (*h*).
Thompson *Seedless* (*h*).
Tokay, *Flame* (*h*).
Victor, *Early*.
Worden.
Zinfandel (*h*).

Peaches.

Alexander.
Beers *Smock*.
Bilyeu.
Brandywine.
Chair *Choice*.
Early Crawford.
Early York.
Elberta.
Foster.
Garey.
Garfield.
Globe.
Golden Cling.
Garland, *Governor*.
Hale.
Heath *Cling*.
Late Crawford.
Lovell.
Malta.
McKevitt *Cling*.
Muir.
Newhall.
Nichols *Cling*.
Orange Cling.
Picquet *Late*.
Reeves *Favorite*
Rivers.
Runyon *Orange Cling*.
St. John, *Yellow*.
Salway.
Smock.
Strawberry.
Stump.
Susquehanna.
Tuskena (*Tuscany*).
Waterloo.
Wilkins.

Nectarines.

Hunt *Tawny*.
Red Roman.

Pears.

Angouleme, *Duchess de*.
Anjou.
Bartlett.
Bosc.
Boussock.
Brandywine.
Clairgeau.
Clapp *Favorite*.
Columbia.
Dana Hovey.
Diel.
Easter *Beurre*.
Flemish *Beauty*.
Glout Morceau.

[1]As explained on page 21, varieties marked (*h*) succeed only in the hottest localities, as at Lewiston and Almota, in Snake River Valley. They are in reality not Upper Sonoran varieties at all, but belong to the Lower Sonoran area.

FRUITS—continued.

Pears—Continued.

Idaho [local in Idaho].
Lawrence.
Louise *Bonne de Jersey*.
Lucrative.
Margaret.
Onondaga.
Osband *Summer*.
Patrick Barry.
Seckel.
Vicar *of Winkfield*.
White Doyenne.
Winter Nelis.

Plums (including prunes).

Agen (*French, Petite*, etc.).
Bavay *Green Gage*.
Bradshaw.
Cherry.
Columbia.
Clyman.
German *Prune*.
Golden Drop, *Coe*.
Golden *Prune*.
Imperial *Gage*.
Italian.
Kanawha.
Lombard.
McLaughlin.
Peach.
Pond (*Hungarian Prune*).
Sergent, *Robe de*.
Shropshire.
Silver *Prune*.
Tragedy.
Washington.
Yellow Egg.

Quinces.

Champion.
Orange.
Portugal.

Raspberries.

Strawberries.

Bubach *No. 5*.
Captain Jack.
Clark *Seedling*.
Crawford.
Jessie.
Longfellow.
Monarch.
Parker Earle.
Sharpless.
Thompson *No. 7*.

NUTS.

European chestnuts.

Combale, *Marron*.
De Lyon, *Marron*.

European walnuts.

Chaberte.
Franquette.
Mayette.
Parisienne.
Prœparturiens.
Serotina.

Filberts and hazelnuts.

Du Chilly.
Lambert.
Piedmont.
Purple Leaf.
Red Aveline.

MISCELLANEOUS.

Alfalfa.
Cowpeas.
Kafir corn.
Hemp.
Lima beans.
Sorghum.
Sugar beet (n).
Sweet potatoes.
Tobacco.
White potatoes.

6. THE LOWER AUSTRAL ZONE.

The Lower Austral zone occupies the southern part of the United States, from Chesapeake Bay to the great interior valley of California. It is interrupted by the continental divide in eastern Arizona and western New Mexico, and is divided, according to conditions of humidity, into an eastern or *Austroriparian*, and a western or *Lower Sonoran*, area.

(*a*) The Lower Sonoran Faunal Area.

The Lower Sonoran area begins with the arid region of Texas in the neighborhood of latitude 98°, and stretches westerly to the Rio Grande Valley, in which it sends an arm northwest to a point a little north of Albuquerque, N. Mex. Another arm reaches up the valley of the Pecos. West of the Rio Grande Valley in New Mexico the Lower Sonoran is interrupted by the continental divide. It begins again in eastern Arizona and sweeps broadly westward below the high plateau, covering southern and western Arizona, the deserts of southern Nevada and eastern California, and the San Joaquin and Sacramento valleys. Followed more in detail, the Lower Sonoran in western Arizona sends a narrow tortuous arm eastward in the Grand Canyon of the Colorado, which expands to cover the lower levels of the Painted Desert, and another arm northward, which enters the extreme southwestern corner of Utah, where it is restricted to the St. George or lower Santa Clara Valley, and is of much agricultural importance.[1] From western Arizona it spreads over southern Nevada, pushes northerly into Pahranagat Valley, sends an arm by way of Oasis and Sarcobatus valleys all the way to the sink of the Humboldt and Carson rivers, fills the whole of Death, Panamint, and Saline valleys and part of Owens Valley, and thence curving southwesterly follows the eastern base of the Sierra Nevada, Tehachapi, and Tejon mountains, and covers the whole of the Mohave and Colorado deserts and all the rest of southern California except the mountains. It sends an arm southward over most of the peninsula of Lower California, and another northward over the San Joaquin and Sacramento valleys.

The Lower Sonoran area comprises the most arid deserts of North America, and is characterized by a fauna and flora of extreme interest. Among the commoner plants are the creosote bush, mesquites, acacias, cactuses, yuccas, and agaves. Among the characteristic birds are the mockingbird, road runner, cactus wren, canyon wren, desert thrashers, hooded oriole, black-throated desert sparrow, Texas nighthawk, and Gambel's quail. Among the distinctive mammals are the four-toed kangaroo rats, Sonoran pocket mice, long-eared desert fox, and the big-eared and tiny white-haired bats. The region, wherever water may be had for irrigation, is of great agricultural importance, particularly for fruit.

[1] Cotton, tobacco, raisin grapes, almonds, olives, figs, and other Lower Sonoran crops are raised successfully in the St. George Valley.

Crops of the Lower Sonoran Faunal Area.

Raisin and wine grapes, oranges, lemons, olives, prunes, peaches, apricots, English walnuts, and almonds are among the important products of the Lower Sonoran area, and the fig ripens several crops each year. Although too far south for the highest development of cereals, several varieties, as the Australian and Sonora wheats, the red rust-proof oats, and the white gourd seed corn, do well. Cotton, tobacco, pyrethrum, and the opium poppy thrive in certain localities, and alfalfa, cowpeas, and canaigre (a plant valuable for tanning) do better than in any other area.

CEREALS.

Barley (*2*).

Corn.

White Gourd Seed (*2*).

Oats.

Red Rust Proof (*2*).

Rye (*2*).

Wheat.

Australian.

Sonora.

FRUITS.

Avocado (*Aguacate*). (*h*)[1]

Apples.

Marshall *Red* (*Red Bellflower*).
Sexton *Golden*.
Skinner *Seedling* (*Santa Clara King*).
Yellow Bellflower.
Yellow Newtown *Pippin*.

Apricots.

Breda.
Hemskirke.
Hinds *Seedling*.
Montgamet, *Alberge de*.
Montgamet Early.
Moorpark.
Peach.
Roman.
Royal.
Royal Golden, *Brier*.
Sparks.
St. Ambroise.
Vestal *Moorpark*.

Cherries.

Early Purple *Guigne*.

Carob.

Cherimoyer. (*h*)[1]

Citron.

Dates. (*h*)[1]

[1] There are several hot pockets in the Lower Sonoran in which tropical or arid tropical fruits may be grown with greater or less success. The best known of these is near Santa Barbara, Calif., where the following are said to flourish: Avocado (*Persea gratissima*), capullin (*Prunus capuli*), cherimoyer (*Anona cherimolia*), kai-apple (*Aberia caffra*), mango (*Mangifera indica*), Moreton Bay chestnut (*Castanospermum australe*), pepino (*Solanum muricatum*), Queensland nut (*Macadamia ternifolia*), rose apple (*Eugenia jambos*), sapodilla (*Achras sapota*), tree tomato (*Cyphomandra betacea*), and zapote blanco (*Casimiroa edulis*).

FRUITS—continued.

Figs.

Adriatic.
Brunswick.
Du Roi.
Genoa, *White.*
Gentile.
Ischia, *White.*
Marseillaise, *White.*
Mission, *Black.*
Monaco Bianco.
Smyrna.
San Pedro Black.
Turkey, *Brown.*

Granadilla.

Grapes.

Alexandria, *Muscat of.*
Black Hamburg.
Emperor.
Feher Szagos.
Gordo Blanco.
Herbemont.
Huasco.
Malaga.
Mission.
Muscat-Hamburg.
Peru, *Rose of.*
Prince, *Black.*
Sultana.
Sweetwater (*Fontainebleau*).
Thompson *Seedless.*
Tokay, *Flame.*
White Muscat.
Zinfandel.

Guavas.

Cattley (*Strawberry*).
Chinese (*Mexican*).

Japanese persimmons.

[Numerous varieties.]

Jujube.

Kumquat.

Lemons.

Eureka.
Genoa.
Sicily.
Villa Franca.

Limes.

Mexican.
Tahiti.

Loquat.

Mandarin oranges.

Satsuma.
Tangerine.

Mulberries.

Black Spanish.
Downing.
Persian.

Olives.

[Numerous varieties.]

Oranges.

Bahia (*Washington Navel*).
Hart Late (*Excelsior*).
Malta Blood.
Maltese Oval.
Mediterranean *Sweet.*
Paper Rind *St. Michael.*
Ruby Blood.
St. Michael.
Valencia *Late.*

FRUITS—continued.

Peaches.

Alexander.
Early Crawford (*n*).
Early York.
Elberta.
Foster (*n*).
Garland, *Governor.*
Hale.
Heath *Cling.*
Henrietta.
Late Crawford (*n*).
Lemon Cling.
Muir.
St. John, *Yellow.*
Strawberry.
Susquehanna.

Nectarines.

Boston.
Downton.
Early Newington.
Early Violet.
Elruge.
Hardwicke.

Pears.

Angoulême, *Duchess de.*
Bartlett.
Bosc.
Boussock.
Brandywine.
Clairgeau.
Easter *Beurre.*
Glout Morceau.
Howell (?).[1]
Lawrence.
Louise *Bonne de Jersey.*
Lucrative.
Patrick Barry.
Pound.
Seckel.
Superfin.
Tyson (?).[1]
White Doyenne.
Winter Nelis.

Pepino (*Solanum muricatum*).

Pineapple (*?*).[1]

Pomegranates.

Pomeloes.

[Several varieties]

Plums (*including prunes*).

Agen (*French, Petite, etc.*).
Caddo Chief.
Columbia.
El Paso.
German *Prune.*
Golden Drop, *Coe.*
Italian (*Fellenberg*).
Jefferson.
Peach.
Sergent, *Robe de.*
Simon (*Prunus simonii*).

Strawberries.

Australian *Crimson.*
Burt.
Longfellow.
Monarch.
Sharpless.

Tamarind.

[1] The interrogation point (?) signifies that the variety or species so marked is included in the list upon information sufficiently positive to make such inclusion necessary, but lacking such full verification as would permit the listing without qualification.

NUTS.

Almonds.

Blowers.
Brier.
Drake.
Golden State.
Gray [southwest Utah].
Harriott.
IXL.
King *Soft Shell.*
Languedoc.
Lewelling.
McCoy.
Ne Plus Ultra.
Nonpareil (*Extra*).
Paper Shell.
Routier, *New.*
Soft Shell, *Routier.*
Supremo.
Tarragona.
Twin, *Routier.*

European walnuts.

Bijou.
Chaberte.
Cluster.
Ford.
Franquette.
Gant (*Bijou*).
Kaghazi.
Mayette.
Mesange (*Paper Shell*).
Mission (*Los Angeles*)
Parisienne.
Prœparturiens.
Santa Barbara.
Serotina.

Peanuts.

Pecans.

Pistachio nut.

MISCELLANEOUS.

Alfalfa.
Black wattle (*Acacia decurrens*).
Canaigre (*Rumex hymenosepalus*).
Castor-oil bean.
Cork oak (*Quercus suber*).
Cotton.
Cowpeas.
Flax (*seed*).
Hemp.
Mustard.
Opium poppy.
Pyrethrum.
Ramie.
Roselle (*Hibiscus sabdariffa*).
Sorghum.
Sugar cane.
Sweet potatoes.
Tagasaste (*Cytisus*).
Tobacco.

(*b*) The Austroriparian Faunal Area.

The *Austroriparian* area occupies the greater part of the South Atlantic and Gulf States. Beginning near the mouth of Chesapeake Bay it covers half or more than half of Virginia, North and South Carolina, Georgia, Florida, Alabama, the whole of Mississippi and Louisiana, eastern Texas, nearly all of Indian Territory, more than half of Arkansas, and parts of Oklahoma, southeastern Kansas, southern Missouri, southern Illinois, the extreme southwestern corner of Indiana, and the bottom lands of western Kentucky and Tennessee. The long leaf and loblolly pines, magnolia, and live oak are common on the uplands; the bald cypress, tupelo, and cane in the swamps. Here the mocking bird, painted bunting, prothonotary warbler, red-cockaded woodpecker, chuck-wills-widow, and the swallow-tail and Mississippi kites are characteristic birds, and the southern fox squirrel, cotton rat, rice-field rat, wood rat, and free-tailed bat are common mammals.

Crops of the Austroriparian Faunal Area.

This is the zone of the cotton plant, sugar cane, rice, pecan, and peanut, and of the scuppernong grape and oriental pears (Le Conte and Kieffer). The more important crops are mentioned in the following list:

CEREALS.

Barley (*2*).

Corn.

Golden Dent.
Hickory King.
Leaming (*2*).
Mosby Prolific.
St. Charles White (*2*) [Mississippi Valley].
Stowell Evergreen (*2*).
White Gourd Seed.

Oats.

Burt.
Red Rust Proof.

Rye (*2*).

Wheat.

Fultz (*2*).
May wheats [away from coast].
Mediterranean (*3*).

FRUITS.

Apples.

Bonum (*n*).
Bradford *Best* (*Kentucky Red*).
Bruce.
Buckingham.
Cannon *Pearmain*.
Carter Blue.
Champlain (*Nyack*) (*n*).
Clark Pearmain.
Cornell *Fancy* (*n*).
Cracking.
Cullasaga.
Disharoon.
Farrar (*Robinson Superb*).
Ferdinand.
Gilpin (*n*).
Green Cheese.
Hall.
Hockett.
Hoover (*n*).
Horn.
Horse.
Jennings.
Julian.
July (*Fourth of July*) (*n*).
Junaluskee.
Limber Twig (*n*).
McAfee (*n*).
Mangum.
Manomet.
Mason Stranger.
Mattamuskeet.
Maverack.
Nansemond.
Nickajack (*n*).
Oconee.
Oldenburg, *Duchess of*.
Ralls *Genet*.
Red Astrachan.
Red June.
Romanite, *South*.
Shockley.
Stephenson.
Switzer [Mississippi Valley].
Taunton.
Watson.
Waugh *Crab*.
White Juneating.
Willow Twig.
Winesap (*n*).
Yates.
Yellow June.
Yellow Transparent.
Yopp.
York Imperial (*n*).

FRUITS—continued.

Apricots.[1]

Breda.
Early Golden.
Hemskirke.
Moorpark.
Musch.
Orange.
Royal.
St. Ambroise.
Turkey.

Cherries.

Archduke (*n*).
Black Heart (*n*).
Choisy, *Belle de* (*n*).
Early Purple *Guigne* (*n*).
Late Duke (*n*).
Magnifique, *Belle* (*n*).
Mayduke (*n*).
Morello, *English* (*n*).
Richmond (*Kentish*) (*n*).

Chinese quince.

Dewberry.

Lucretia.

Figs.

Brunswick.
Green Ischia.
Turkey, *Brown.*

Grapes.[2]

Berckmans.
Brighton (*n*).
Brilliant [Mississippi Valley].
Catawba.
Cynthiana.
Delaware (*n*).
Diamond, *Moore* (*n*).
Elvira.
Flowers.
Goethe (*n*).
Herbemont.
Jefferson (*n*).
Lenoir.
Lindley (*n*).
Missouri Reisling [Mississippi Valley].
Moore *Early* (*n*).
Niagara (*n*).
Norton *Virginia.*
Salem (*n*).
Scuppernong.
Tenderpulp.
Thomas.
Triumph.
Wylie, *Peter.*

Japanese persimmons.

Costata.
Hachiya.
Okame.
Yemon.

Mulberries.

Downing.
Hicks.
Stubbs.

[1] Apricots are too often injured by late spring frosts to be a profitable crop in the Austroriparian.

[2] Varieties followed by the letter (*n*) belong to the Carolinian area, but thrive also along the upper edge of the Austroriparian.

FRUITS—continued.

Peaches.

Alexander (*n*).
Amelia.
Austin.
Blood Cling.
Blood Free.
Cabler *Indian*.
Chinese *Cling*.
Columbia.
Early Crawford (*n*).
Early York (*n*).
Elberta.
Hale (*n*).
Heath *Cling* (*n*).
Hoover.
Kerr, *Jessie*.
Late Crawford.
Lee, *General*.
Lemon Cling.
Mountain Rose (*n*).
Oldmixon Cling (*n*).
Pallas.
Picquet *Late*.
Sneed.
St. John, *Yellow*.
Thurber.
Tillotson.

Pears.

Angoulême, *Duchess de* (*n*).
Garber.
Julienne (*n*).
Kieffer.
Lawrence (*n*).
Le Conte.
Magnolia.
Rostiezer (*n*).
Seckel (*n*).
Tyson (*n*).

Plums.

Abundance (*Botan*).
Berckmans.
Burbank.
Caddo Chief [western].
Caradeuc, *De*.
Chabot.
Cumberland.
El Paso [western].
Georgeson (*Hattankio*).
Golden Beauty.
Kerr (*Hattankio 2*).
Indian Chief.
Lone Star.
Marianna.
Miner.
Newman.
Red Nagate.
Satsuma.
Transparent, *Yellow*.
Weaver.
Wild Goose.

Pomegranates.

Strawberries.

Bubach *No. 5* (*n*).
Cloud [Mississippi Valley].
Crescent.
Gandy (*n*).
Hoffman.
Michel *Early*.
Parker Earle.
Thompson, *Lady*.
Warfield [Mississippi Valley].

NUTS.

Almonds.[1]

English walnuts.

Pecans.

Peanuts.

[1] Almonds are grown in the Austroriparian area, but are not a commercial success.

MISCELLANEOUS.

Castor bean.
China grass.
Cotton.
Cowpeas.
Jute.
Lima beans.
Rice.
Sorghum.
Sugar cane.
Sweet potatoes.
Tea.[1]
Tobacco.
Turpentine.

(*c*) Semitropical or Gulf Strip.

The Gulf strip, or southern part of the Austroriparian area (colored orange on the map), reaches from Texas to southern Florida, covers a narrow strip in southern Georgia, and probably follows the coastal lowlands northward into South Carolina, though not so indicated on the map. It has a semitropical climate and is the home of a number of plants and animals not found farther north, among which are the cabbage palmetto, Cuban pine, ground dove, white-tailed kite, Florida barred and screech owls, Chapman's nighthawk, the Florida and boat-tailed grackles, and several small mammals.

Crops of the Semitropical or Gulf Strip.

The Gulf strip, though small in area, is of very great importance from the standpoint of agriculture and horticulture. It is the belt in which rice, sugar cane, and the much-prized Sea Island cotton are produced in greatest quantity and value; and, as a fruit belt, has no competitor except the Lower Sonoran areas of California and Arizona. Bitter oranges, loquats, granadillas, figs, Japanese persimmons, pecan nuts, and numerous varieties of peaches and grapes thrive here, and the citrus fruits (oranges, mandarins, lemons, limes, and shaddocks) are grown successfully in the warmer parts, particularly in peninsular Florida, but in the northern parts have suffered severely from frosts. The more important agricultural products are mentioned in the following list:

CITRUS FRUITS.

Bergamot oranges (*P*)[2].

Bitter oranges.

Lemons (*P*).

Belair.
Eureka.
Genoa.
Sicily.
Villa Franca.

[1] Tea is grown successfully at Summerville, near Charleston, S. C., and would doubtless thrive in other parts of the Austroriparian belt; but the cost of picking the leaves is so great as to discourage its general cultivation.

[2] The letter (*P*) indicates that the fruit after which it is placed is cultivated successfully in peninsular Florida only, except in a few cases where it thrives also in the Mississippi delta below New Orleans.

CITRUS FRUITS—continued.

Mandarins.

Cleopatra (*P*).
Dancy *Tangerine* (*P*).
King (*P*).
Satsuma.
Tangerona (*P*).

Oranges (*P*).

Bahia (*Washington Navel*).
Beach *No. 5*.
Bessie.
Boone *Early*.
Buttercourt.
Centennial.
Circassian.
Colmar.
Cunningham.
Drake *Star*.
Dulcissima.
Du Roi.
Foster.
Hart *Late* (*Excelsior*).
Higley *Late*.
Imperial *Blood*.
Jaffa.
Jaffa Blood.
Lamb Summer.
Magnum Bonum.
Maltese Oval.
Mediterranean *Sweet*.
Nonpareil.
Oblong, *Early*.
Old Vini.
Parson *Brown*.
Pineapple.
St. Michael.
St. Michael Blood.
Star Calyx.
Thorpe *Trophy*.
Valencia *Late*.
Vinous, *Madame*.

Pomeloes (*P*).

Aurantium.
Blood.
Forbidden Fruit.
Hart.
Josselyn.
Mammoth.
Seedless.
Triumph.
Walter.

OTHER FRUITS.

Apples.

Jennings.
Red Astrachan.

Chinese quince.

Dewberry.

Lucretia.

Figs.

Adriatic, *White*.
Celestial.
Magnolia.
Marseillaise, *White*.

Granadillas.

Grapes.

Elvira.
Flowers.
Herbemont.
Scuppernong.
Tenderpulp.
Thomas.
Wylie, *Peter*.

OTHER FRUITS—continued.

Guavas (*P.*).

Cattley (*Strawberry*).
Chinese (*Mexican*).

Japanese persimmons.

Costata.
Hachiya.
Hiyakume.
Kurokuma.
Okame.
Tane Nashi.
Tsuru.
Yedo-ichi.
Yemon.
Zengi.

Kumquats (*P.*).

Loquats.

Peaches.

Angel.
Bidwell Early (*P.*).
Bidwell Late (*P.*).
Cabler Indian.
Climax.
Countess.
Early China (*P.*).
Ferdinand.
Florida Crawford.
Gibbon.
Honey.
Imperial.
Maggie *Burt.*
Onderdonk.
Pallas.
Peento (*P.*).
Waldo.

Pears.

Garber.
Kieffer.
Le Conte.
Magnolia.

Plums.

Kelsey.
Satsuma.
Wild Goose.

Pomegranates.

Strawberries.

Hoffman.
Michel *Early.*
Neunan.
Thompson, *Lady.*

NUTS.

Peanuts.

Pecans.

MISCELLANEOUS.

China grass [for fiber].
Cotton.
Jute.
Rice.
Sea Island cotton.
Sorghum.
Sugar cane.
Sweet potatoes.
Tobacco.

7. THE TROPICAL REGION.

The Tropical region within the United States is of small extent and is restricted to three widely separated localities—southern Florida, extreme southeast Texas (along the lower Rio Grande and Gulf coast),

and the valley of the lower Colorado River in Arizona and California. The Florida area is genuine humid tropical; the Texas and Arizona-California areas are dilute arid tropical.

Among the tropical trees that grow in southern Florida are the royal palm, Jamaica dogwood, manchineel, mahogany, and mangrove; and among the birds are the caracara eagle, white-crowned pigeon, zenaida dove, quail doves, a Bahama vireo, and the Bahama honey creeper. The absence of characteristic tropical mammals and the relatively small number of tropical birds in Florida is due to the lack of land connection with other tropical areas; while the presence of the jaguar, ocelot, and other tropical cats, the armadillo, and a considerable number of tropical birds in southeastern Texas is the direct result of the continuous extension of the Tamaulipan arid tropical fauna from Mexico into Texas. The extension of the arid tropical along the lower Colorado and Gila rivers is over a desert region of such excessive aridity that only desert mammals and birds can live there. The flora has not been sufficiently studied, but is characterized by giant cactuses, desert acacias, palo verdes, and the Washington or fan-leaf palm.

Crops of the Tropical Region.

With irrigation the arid tropical areas are found to be as productive as the humid tropical, but they have been cultivated so short a time that their capabilities can only be inferred from the circumstance that bananas, citrons, dates, guavas, lemons, loquats, oranges, and Mexican limes do well in the Arizona-California arm. No information is at hand relating to the Texan or Tamaulipan arm.

Tropical Florida, with its handsome cocoanut palms and extensive banana fields, has been longer under cultivation, but its full capacity is still unknown, and the following list must be regarded as far from complete:

Crops of Tropical Florida.

CITRUS FRUITS.

Bergamot Orange (*Citrus bergamium*).
Citrons.
Lemons.
Limes.
Mandarins.
Oranges.
Pomeloes.

OTHER FRUITS.

Avocado (*Aguacate*).
Amatungula (*Carissa arduina*).
Banana.
Barbados gooseberry (*Pereskia aculeata*).
Caraunda, Christ thorn (*Carissa carandas*).
Cape gooseberry (*Physalis peruviana*).
Cashew nut.
Carob or St. John's bread (*Ceratonia siliqua*).
Cherimoyer.
Cocoanut.
Custard apple (*Anona reticulata*).
Date.
Downy myrtle (*Rhodomyrtus tomentosa*).
Egg fruit.

OTHER FRUITS—continued.

Ginep or Spanish lime.
Granadilla.
Guava.
Hog plum (Ximenia).
Kumquat.
Loquat.
Mammee apple.
Mammee sapota.
Mango.
Melon papaw (Carica papaya).
Monstera deliciosa.
Otaheite gooseberry (Phyllanthus distichus).
Pepino (Solanum muricatum).
Pineapple.
Pond apple (Anona glabra).
Rose apple (Eugenia jambos).
Sapodilla (Achras sapota).
Soursop (Anona muricata).
Southern dewberry (Rubus trivialis).
Strawberry tomato (Physalis alkekengi).
Sugar apple (Anona squamosa).
Surinam cherry (Eugenia uniflora).
Tamarind.

MISCELLANEOUS. [1]

Camphor.
Coffee.
Ramie.
Sisal hemp.
Tobacco.

[1] Eggplants, tomatoes, beans, and some other garden vegetables are important crops in tropical Florida, but as the varieties of these have not yet been arranged by zones they can not be given here.

PART III.

LAWS OF TEMPERATURE CONTROL OF THE GEOGRAPHIC DISTRIBUTION OF ANIMALS AND PLANTS.[1]

Apart from obvious mechanical barriers, such as oceans, temperature is the most important single factor in fixing the limits beyond which particular species of animals and plants can not go. Investigations conducted by the Biological Survey have shown that *the northward distribution of terrestrial animals and plants is governed by the sum of the positive temperatures for the entire season of growth and reproduction*,[2] and that *the southward distribution is governed by the mean temperature of a brief period during the hottest part of the year*.[3]

ZONE TEMPERATURES.

The Boreal Region.

Arctic, Hudsonian, and Canadian zones.—The distinctive temperatures of the three Boreal zones (Arctic, Hudsonian, and Canadian) are not positively known, but the southern limit of the Boreal as a whole is marked by the isotherm of 18° C. (64.4° F.) for the six hottest consecutive weeks of summer. It seems probable, from the few data available, that the limiting temperatures of the southern boundaries of the Hudsonian and Arctic zones are, respectively, 14° C. (57.2° F.) and 10° C. (50° F.) for the same period.

[1] Abridged from a paper by the author entitled 'Laws of temperature control of the geographic distribution of terrestrial animals and plants.' National Geographic Magazine, Vol. VI, pp. 229–238, 3 colored maps, December, 1894.

[2] In computing the sum of the positive or effective temperatures a minimum temperature of 6° C. (43° F.) has been assumed as marking the inception of the period of physiological activity in plants and of reproductive activity in animals. The effective temperatures or degrees of normal mean daily heat in excess of this minimum have been added together for each station, beginning when the normal mean daily temperature rises higher than 6° C. in spring and continuing until it falls to the same point at the end of the season. The sums thus obtained were platted on a large scale map of the United States and connected by isotherms, which were found to conform in the most gratifying manner with the northern boundaries of the several life zones.

[3] The exact length of this period has not been determined. It must be short enough to fall within the hottest part of the summer in high northern latitudes, and probably increases in length from the north southward. For experiment, the mean normal temperature of the six hottest consecutive weeks was arbitrarily chosen and platted on a large scale map. Isotherms were then drawn, which conformed so closely with the southern boundaries of the Boreal, Transition, and Upper Austral zones that the matter was not carried further.

The Austral Region.

Transition zone species require a total quantity of heat of at least 5,500° C. (10,000° F.), but can not endure a summer temperature the mean of which for the six hottest consecutive weeks exceeds 22° C. (71.6° F.). The northern boundary of the Transition zone, therefore, is marked by the isotherm showing a sum of normal positive temperatures of 5,500° C. (10,000° F.), while its southern boundary is coincident with the isotherm of 22° C. (71.6° F.) for the six hottest consecutive weeks.

Upper Austral species require a total quantity of heat of at least 6,400° C. (11,500° F.), but apparently can not endure a summer temperature the mean of which for the six hottest consecutive weeks exceeds 26° C. (78.8° F.). The northern boundary of the Upper Austral zone, therefore, is marked by the isotherm showing a sum of normal positive temperatures of 6,400° C. (11,500° F.), while its southern boundary agrees very closely with the isotherm of 26° C. (78.8° F.) for the six hottest weeks.

Lower Austral species require a total quantity of heat of at least 10,000° C. (18,000° F.). The northern boundary of the Lower Austral zone, therefore, is marked by the isotherm showing a sum of normal positive temperatures of 10,000° C. (18,000° F.).

The Tropical Region.

Tropical species require a total quantity of heat of at least 14,400° C. (26,000° F.); and since the tropical life region is a broad equatorial belt, it is probable that both its northern and southern boundaries are marked by the isotherm showing a sum of normal positive temperatures of 14,000° C. (26,000° F.).

Governing temperatures of the zones.

Regions.	Zones.	Governing temperatures. Northern limit. Sum of normal mean daily temperatures above 6° C. (43° F.).		Southern limit. Normal mean temperature of six hottest consecutive weeks.	
		°C.	°F.	°C.	°F.
Boreal	Arctic	----	----	[1] 10	[1] 50
	Hudsonian	----	----	[1] 14	[1] 57.2
	Canadian	----	----	18	64.4
Austral	Transition	5,500	[2] 10,000	22	71.6
	Upper Austral	6,400	11,500	26	78.8
	Lower Austral	10,000	18,000	----	----
Tropical	----	14,500	26,000	----	----

[1] Estimated from insufficient data.
[2] The Fahrenheit equivalents of centigrade sum temperatures are stated in round numbers to avoid small figures of equivocal value.

PART IV.

CROP TABLES.

The accompanying tables are arranged to show, under the head of particular crops (as cereals, apples, pears, and so on), the zone ranges of the more important varieties. Fruits having very limited zone ranges, as oranges and guavas, are not included, because they are so easily found under their appropriate zones in the text.

Incidentally, the tables serve to bring out the interesting fact that while a few varieties, as the Red Astrachan apple and Bartlett and Seckel pears, have wide ranges, thriving in as many as three zones, the vast majority are restricted to two, and a considerable number to a single zone.

Additions and corrections are earnestly desired.

CEREALS.

Cereals taken collectively thrive best in cool climates and are most successful in the Transition and Upper Austral zones. This is particularly true of oats and wheat. Corn, while no exception to the rule, has more varieties adapted to the Lower Austral, as appears in the accompanying table.

Zone ranges of oats, wheat, and corn.

[KEY.—(2) and (3) of second or third rate in the area.]

TRANSITION ZONE.

Transition areas as a whole.	Transition areas as a whole.
Oats:	*Wheat*—Continued.
American Banner.	Saskatchewan Fife.
Black Tartarian.	Scotch Fife.
Lincoln.	*Corn:*
Welcome.	Angel of Midnight.
White Russian.	Canadian Eight-Row Yellow Flint.
Wheat:	King Philip.
Australian (3).	Longfellow.
Clawson.	Pride of the North.
Fultz (2).	Squaw.
Ladoga.	Stowell Evergreen (2 and local).
Red Fife.	

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Oats:	*Oats:*
Lincoln (2).	Lincoln (2).
Red Rust Proof.	Red Rust Proof (2).
Welcome.	Welcome (2).
White Russian (2).	White Russian (2).

Zone ranges of oats, wheat, and corn—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Wheat: Clawson. Fulcaster. Fultz. Mediterranean. Turkey Red [Mississippi Valley]. Velvet Chaff. *Corn:* Bloody Butcher. Golden Dent (2). Hickory King (2). King Philip (3). Leaming. St. Charles White [Lower Mississippi Valley] (2). Stowell Evergreen. White Gourd Seed (2).	*Wheat:* Australian. Fultz (3). May wheats (3). Mediterranean (2). Sonora. Turkey Red (2). Velvet Chaff (2). *Corn:* Hickory King (3). King Philip (2). Leaming (2). Pride of the North (3). Squaw (3).

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.
Oats: Red Rust Proof (2). *Wheat:* Australian. Sonora. *Corn:* White Gourd Seed (2).	*Oats:* Burt. Red Rust Proof. *Wheat:* May wheats [away from coast]. Mediterranean (3). Fultz (2). *Corn:* Golden Dent. Hickory King. Leaming (2). Mosby Prolific. St. Charles White [Mississippi Valley] (2). Stowell Evergreen (2). White Gourd Seed.

APPLES.

Apples rank among the staple crops of the United States. A multitude of varieties flourish in the Transition and Upper Austral zones and a smaller number in the Lower Austral, as may be seen from the following table. One variety, the Red Astrachan, is remarkable for the wide range of climatic conditions it is able to endure, as it appears to thrive in all the zones and in all the areas except the most arid. Many varieties are restricted to a single zone, but the greater number are common to two adjoining zones, as the Transition and Upper Austral, or the Upper and Lower Austral.

Crab apples are almost restricted to the Transition zone, only four varieties being known to flourish farther south, and all of these are Transition varieties.

Zone ranges of apples.

[KEY.—Cross (+), do not thrive in the Upper Mississippi section (Wisconsin, Minnesota, and the eastern Dakotas) except in eastern Wisconsin in vicinity of Green Bay; (*n*), in northern part only; (*s*), in southern part only; (*?*), information sufficiently positive to make the listing necessary, but lacking such full verification as to require qualification.]

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
Alexander.	Alexander.	Baldwin.
+Bailey *Sweet* (*s*).	Baldwin.	Ben Davis (*s*).
+Baker.	Dutch Mignonne.	Blue Pearmain.
+Baldwin.	Dyer (*Pomme Royal*).	Early Harvest (*s*).
+Benoni (*s*).	Early Harvest.	Esopus *Spitzenburg*.
+Bietigheimer (*s*).	Early Strawberry.	Fall Pippin (*s*).
+Blenheim.	Esopus *Spitzenburg*.	Gravenstein.
+Blue Pearmain.	Fameuse.	Jonathan (*s*).
+Bullock (*American Golden Russet*).	Golden Russet.	Keswick.
	Golden Sweet.	Maiden Blush.
+Canada Reinette.	Gravenstein.	Monmouth.
+Chenango (*s*).	Hightop *Sweet*.	Northern Spy.
+Clyde *Beauty*.	Hubbardston.	Oldenburg, *Duchess of*.
+Cogswell (*s*).	Jefferis.	Rambo (*s*).
+Danvers (*s*).	Jonathan.	Red Astrachan.
+Domine (*s*).	Keswick.	Red June (*s*).
+Dutch Mignonne (*s*).	Longfield.	Rhode Island *Greening*.
+Dyer (*Pomme Royal*) (*s*).	Lowell.	Sops of Wine.
+Early Harvest.	Maiden Blush.	Swaar.
+Early Ripe (*s*).	Monmouth.	Tompkins King.
+Early Strawberry (*s*).	Mother.	Wagener.
+Esopus *Spitzenburg*.	Newtown Spitzenburg.	Wealthy.
+Ewalt (*s*).	Northern Spy.	Winesap (*s*).
+Fall Pippin.	Oldenburg, *Duchess of*.	Yellow Bellflower (*s*).
+Fameuse.	Pewaukee.	Yellow Newtown *Pippin* (*s*).
+Garden Royal.	Porter.	Yellow Transparent.
+Golden Russet.	Primate.	
+Golden Russet [New York] (*s*)	Rambo.	
+Golden Sweet.	Red Astrachan.	
+Gravenstein.	Rhode Island *Greening*.	
+Green Sweet.	Roman Stem.	
Haas (*Fall Queen*) [Mississippi Valley].	Rome Beauty.	
	Roxbury.	
+Hightop *Sweet*.	Sops of Wine.	
+Hubbardston.	Summer Pearmain	
+Hunt *Russet*.	Swaar.	
+Jefferis (*s*).	Tetofski.	
+Jefferson County.	Tolman *Sweet*.	
+Jewett *Red*.	Tompkins King.	
+Jonathan (*s*).	Twenty-Ounce.	
+Keswick (*s*).	Wagener.	
Longfield.	Wealthy.	
+Lowell (*s*).	Westfield.	
+McIntosh.	Williams *Favorite*.	
McMahon.	Wine, *Hays*.	
+Maiden Blush (*s*).	Winesap (*?*).	
+Margaret, *Early Red* (*s*).	Wolf *River*.	
+Melon, *Norton* (*s*).	Yellow Newtown *Pippin*.	
+Minister.	Yellow Transparent.	
+Montreal Peach.		
+Moore Sweet (*s*).		
+Mother (*s*).		
+Newtown Spitzenburg (*s*).		
+Northern Spy.		
+Ohio Nonpareil (*s*).		
Oldenburg, *Duchess of*.		
+Ontario.		
+Peck *Pleasant*.		
+Perry Russet.		
Pewaukee.		
+Pomme Gris.		
+Porter (*s*).		
+Primate (*s*).		
+Pumpkin Sweet (*Pound Sweet*).		
+Rambo (*s*).		
+Red Astrachan.		
+Red Canada.		
+Rhode Island *Greening*.		
+Ribston.		
+Rolfe.		
Roman Stem.		
+Roxbury.		
+St. Lawrence.		
+Scott Winter.		
+Shiawassee.		

Zone ranges of apples—Continued.

TRANSITION ZONE—Continued.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
+Sops of Wine.		
+Sterling (*American Beauty*).		
+Summer Pearmain (*s*).		
Sutton.		
+Swaar (*s*).		
Tetofski.		
+Tolman *Sweet*.		
+Tompkins King.		
+Twenty-Ounce.		
+Vandevere (*s*).		
+Wagener.		
Wealthy.		
Westfield.		
+Williams *Favorite*.		
+Wine, *Hays* (*s*).		
Wolf *River*.		
Yellow Transparent.		
Crab apples:		
Beach.		
Brier.		
+Elgin.		
Excelsior.		
Gibb.		
+Hyslop.		
Martha.		
Marengo.		
Minnesota.		
Montreal.		
Orange.		
Red Siberian.		
Transcendent.		
+Van Wyck.		
Whitney *No. 20*.		
Yellow Siberian.		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Arkansas (*Mammoth Black Twig*).	Alameda, *Beauty of*.
Bailey *Sweet*.	Belmont.
Baldwin (*n*).	Ben Davis.
Belmont.	Blue Pearmain.
Ben Davis.	Cook *Seedling*.
Benoni.	Dyer (*Pomme Royal*).
Bentley.	Early Harvest.
Bonum.	Early Pennock.
Bough, *Sweet*.	Early Strawberry.
Bradford *Best* (*Kentucky Red*).	Esopus *Spitzenburg*.
Broadwell.	Fall Jenneting.
Buckingham.	Fall Orange.
Cannon *Pearmain*.	Fall Pippin.
Champlain (*Nyack*).	Fall Wine.
Clayton.	Gloria Mundi.
Cornell *Fancy*.	Golden Russet.
Cullasaga.	Golden Sweet.
Domine (*n*).	Grimes *Golden*.
Dyer (*Pomme Royal*).	Haas (*Fall Queen*).
Early Cooper.	Hawthornden.
Early Harvest.	Hightop *Sweet*.
Early Joe.	Holland *Pippin*.
Early Pennock.	Hubbardston.
Early Strawberry.	Jersey Sweet.
Edward *Early*.	Jonathan.
Esopus (*n*).	Keswick.
Evening Party.	Lady Sweet.
Ewalt.	Lawver (*Delaware Red Winter*).
Fallawater.	Limber Twig.
Fall Orange.	Lowell.
Fall Pippin.	Maiden Blush.
Fall Wine.	McAfee.
Fanny.	Marshall *Red* (*Red Bellflower*).
Fink.	Missouri *Pippin*.
Fulton.	Monmouth *Pippin* (*Red Cheek Pippin*).
Gilpin.	Mother.
Golden Russet (*n*)	Newtown Spitzenburg.
Golden Sweet.	Nickajack.

Zone ranges of apples—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Green Cheese.	Northern Spy.
Green Newtown.	Oldenburg, *Duchess of.*
Grimes *Golden.*	Porter.
Haas (*Fall Queen*).	Primate.
Hewes *Crab.*	Ralls *Genet.*
Hightop *Sweet* [Mississippi Valley].	Rambo.
Hoover.	Red Astrachan.
Horse.	Red Canada.
Hubbardston (*n*).	Red June.
Jefferis.	Rhode Island *Greening.*
Jersey Sweet.	Roman Stem.
Jonathan (*n*).	Rome Beauty.
July (*Fourth of July*).	Smith *Cider.*
Keswick	Summer Pearmain.
Kinnaird.	Summer Queen.
Lady.	Summer Rose.
Lady Sweet.	Swaar.
Lansingburg.	Tetofski.
Late Strawberry.	Tompkins King.
Lawver (*Delaware Red Winter*).	Twenty-Ounce.
Limber Twig.	Wagener.
Lowell.	Wealthy.
McAfee.	Westfield.
McLellan.	White Pearmain.
Maiden Blush.	Wine, *Hays.*
Mangum.	Winesap.
Margaret, *Early Red.*	Wolf *River.*
Milam.	Yellow Bellflower.
Missouri *Pippin.*	Yellow Newtown *Pippin.*
Melon, *Norton* (*n*).	
Monmouth.	
Moore Sweet.	
Mother.	
Newtown Spitzenburg.	
Nickajack.	
Northern Spy (*n*).	
Ohio Nonpareil.	
Oldenburg, *Duchess of.*	
Ontario (*n*).	
Ortley.	
Otoe (*n*).	
Perry Russet (*n*).	
Porter.	
Primate.	
Pryor *Red.*	
Ralls *Genet.*	
Rambo.	
Ramsdell *Sweet.*	
Red Astrachan.	
Red June.	
Red Stripe.	
Rhode Island *Greening* (*n*).	
Romanite, *South.*	
Roman Stem.	
Rome Beauty.	
Shockley.	
Smith *Cider.*	
Smokehouse.	
Sops of Wine (*n*).	
Stark (*n*).	
Summer Pearmain.	
Summer Queen.	
Summer Rose.	
Sutton (*n*).	
Swaar (*n*).	
Sweet Winesap.	
Tetofski.	
Tompkins King (*n*).	
Trenton Early.	
Twenty-Ounce (*n*).	
Vandevere.	
Wagener (*n*).	
Walbridge (*Edgar Red Streak*).	
Westfield (*n*).	
White Juneating.	
White Pearmain.	
White Pippin.	
Willow Twig.	
Wine, *Hays* (*n*).	
Winesap.	
Wythe.	

Zone ranges of apples—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Yellow Bellflower. Yellow Newtown *Pippin* (*Albemarle*). Yellow Transparent. York Imperial. *Crab apples;* Hyslop. Martha. Transcendent. Yellow Siberian.	

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Marshall *Red* (*Red Bellflower*). Sexton *Golden*. Skinner *Seedling* (*Santa Clara King*). Yellow Bellflower. Yellow Newtown *Pippin*.	Bonum (*n*). Bradford *Best* (*Kentucky Red*). Bruce. Buckingham. Cannon *Pearmain*. Carter Blue. Champlain (*Nyack*) (*n*). Clark Pearmain. Cornell *Fancy* (*n*). Cracking. Cullasaga. Disharoon. Farrar (*Robinson Superb*). Ferdinand. Gilpin (*n*). Green Cheese. Hall. Hockett. Hoover (*n*). Horn. Horse. Jennings. Julian. July (*Fourth of July*) (*n*). Junaluskee. Limber Twig (*n*). McAfee (*n*). Mangum. Manomet. Mason Stranger. Mattamuskeet. Maverack. Nansemond. Nickajack (*n*). Oconee. Oldenburg, *Duchess of*. Ralls *Genet*. Red Astrachan. Red June. Romanite, *South*. Shockley. Stephenson. Switzer [Mississippi Valley]. Taunton. Watson. Waugh *Crab*. White Juneating. Willow Twig. Winesap (*n*). Yates. Yellow June. Yellow Transparent. Yopp. York Imperial (*n*).	Jennings. Red Astrachan.

APRICOTS.

Apricots require a warm climate and do best in the dry summer heat of the Upper and Lower Sonoran areas. They bloom early and are easily injured by frosts, for which reason they are a precarious crop in the Eastern States.

Zone ranges of apricots.

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Alexander [Mississippi Valley].	Alexander.
Breda.	Blenheim.
Budd [Mississippi Valley].	Breda.
Early Golden.	Budd.
Gibb [Mississippi Valley].	Eureka.
Harris.	Gibbs.
Hemskirke.	Hemskirke.
Large Early.	Large Early.
Moorpark.	Montgamet, *Alberge de.*
Peach.	Montgamet Early.
	Moore Early.
	Moorpark.
	Newcastle.
	Peach.
	Pringle.
	Royal Golden, *Brier.*
	St. Ambroise.
	Vestal *Moorpark.*

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.
Breda.	Breda.
Hemskirke.	Early Golden.
Hinds *Seedling.*	Hemskirke.
Montgamet, *Alberge de.*	Moorpark.
Montgamet Early.	Musch.
Moorpark.	Royal Orange.
Peach.	St. Ambroise.
Roman.	Turkey.
Royal.	
Royal Golden, *Brier.*	
St. Ambroise.	
Sparks.	
Vestal *Moorpark.*	

CHERRIES.

Cherries like a warm temperate climate, and do best in the Upper Austral zone, although some varieties flourish in the Transition and others in the Lower Austral. In both of these extremes, however, it will be observed that by far the greater number are confined to those parts of the zones which lie nearest to the Upper Austral (as indicated by the letter (*s*) in the Transition list, and the letter (*u*) in the Austroriparian list).

Zone ranges of cherries.

[KEY.—Cross (+), do not thrive in the Upper Mississippi section (Wisconsin, Minnesota, and the eastern Dakotas) except in eastern Wisconsin in vicinity of Green Bay; (*n*), in northern part only; (*s*), in southern part only; (*?*), information sufficiently positive to make the listing necessary, but lacking such full verification as to require qualification.]

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
+Archduke.	Archduke.	Advance *California*.
Bessarabian.	Choisy, *Belle de*.	Bing.
+Black Heart (*s*).	Ostheimer *Weichsel*.	Centennial.
+Buttner, *Yellow* (*s*).		Coe *Transparent*.
+Choisy, *Belle de*.		Elton.
+Coe *Transparent* (*s*).		Lewelling (*Black Republican*).
+Donna Maria (*s*).		Napoleon (*Royal Ann*).
+Downer (*s*).		Richmond (*Kentish*).
+Dyehouse (*s*).		Rockport.
+Eagle, *Black* (*s*).		Spanish, *Yellow*.
+Early Purple *Guigne* (*s*).		Tartarian, *Black*.
+Elton (*s*).		Windsor.
+Eugenie, *Empress* (*s*).		Wood, *Governor*.
+Florence (*s*).		
+Hortense, *Reine* (*s*)		
+Hovey (*s*).		
Late Kentish.		
Lutovka.		
+Magnifique, *Belle* (*s*).		
+Mayduke (*s*).		
+Montmorency Large.		
+Montmorency Ordinaire.		
Morello, *English*.		
+Napoleon (*s*).		
+Olivet (*s*).		
+Philippe, *Louis* (*s*).		
+Plumstone Morello.		
Richmond (*Kentish*).		
+Tartarian, *Black*.		
+Windsor.		
+Wood, *Governor*.		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Archduke (*n*).	Archduke.
Black Heart.	Bing.
Carnation.	Centennial.
Choisy, *Belle de*.	Choisy, *Belle de*.
Coe *Transparent* (*n*).	Cleveland.
Downer (*n*).	Early Purple *Guigne*.
Dyehouse.	Late Duke.
Eagle, *Black*.	Lewelling (*Black Republican*).
Early Purple *Guigne*.	Mayduke.
Elton (*n*).	Montmorency Large.
Eugenie, *Empress*.	Montmorency Ordinaire.
Hortense, *Reine*.	Morello, *English*.
Knight *Early*.	Napoleon (*Royal Ann*).
Late Kentish.	Olivet.
Magnifique, *Belle*.	Ostheimer *Weichsel*.
Mayduke.	Richmond (*Kentish*).
Morello, *English*.	Rockport.
Napoleon (*Royal Ann*).	Spanish, *Yellow*.
Olivet.	Tartarian, *Black*.
Plumstone Morello.	Thompson *Seedling*.
Richmond.	Windsor.
Rockport (*n*).	Wood, *Governor*.
Spanish, *Yellow*.	
Tartarian, *Black*.	
Windsor.	
Wood, *Governor*.	

Zone ranges of cherries—Continued.

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.
Early Purple *Guigne* (?).	Archduke (*n*). Black Heart. Choisy, *Belle de* (*n*). Early Purple *Guigne* (*n*). Late Duke. Magnifique, *Belle* (*n*). Mayduke (*n*). Morello, *English* (*n*) Richmond (*Kentish*) (*n*).

GRAPES.

Grapes of high excellence and in great variety flourish in all the zones from the Transition to the Lower Austral, inclusive, although no single variety does well in more than two zones. The following table contains only the more important varieties, and might be largely extended, particularly in the Lower Sonoran area:

Zone ranges of grapes.

[KEY.—Cross (+), do not thrive in the Upper Mississippi section (Wisconsin, Minnesota, and the eastern Dakotas) except in eastern Wisconsin in vicinity of Green Bay; (*h*), in hottest part only; (*n*), in northern part only; (*s*), in southern part only].

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
Agawam. +Barry. Champion. Clinton. Concord. Cottage. +Diana. +Martha. Moore *Early*. +Salem. Vergennes. Victor, *Early*. +Wilder. Winchell (*Green Mountain*). Worden.	Wilder. Worden.	Concord. Isabella. Moore *Early*.

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Agawam (*n*). Barry (*n*). Brighton. Catawba. Champion. Clinton (*n*). Concord. Cynthiana (*s*). Delaware. Diamond (*n*). Diana (*n*). Duchess. Elvira (*s*). Goethe (*s*). Iona (*n*).	Agawam. Alexandria, *Muscat of* (*h*). Black Ferrara. Black Hamburg. Catawba. Chasselas Red. Chasselas Rose. Concord. Delaware. Elvira. Emperor (*h*). Isabella. Ives. Malaga (*h*). Massasoit.

Zone ranges of grapes—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Isabella.	Mission.
Ives.	Moore *Early*.
Jefferson.	Norton *Virginia*.
Lindley.	Peru, *Rose of* (*h*).
Missouri Reisling (*s*).	Pierce (*Isabella Regia*).
Moore *Early*.	Prince *Black*.
Niagara.	Royal Muscatine (*h*).
Noah [Southern Mississippi Valley.] (*s*).	Salem.
Norton *Virginia* (*s*).	Sweetwater (*Fontainebleau*) (*h*).
Pocklington (*n*).	Thompson *Seedless* (*h*).
Prentiss (*n*).	Tokay, *Flame* (*h*).
Salem.	Victor, *Early*.
Telegraph.	Worden.
Ulster (*n*).	Zinfandel (*h*).
Worden (*n*).	
Wyoming.	

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Alexandria, *Muscat of*.	Berckmans.	Elvira.
Black Hamburg.	Brighton (*n*).	Flowers.
Emperor.	Brilliant [Mississippi Valley].	Herbemont.
Feher Szagos.	Catawba.	Norton *Virginia*.
Gordo Blanco.	Cynthiana.	Scuppernong.
Herbemont.	Delaware (*n*).	Tenderpulp.
Huasco.	Diamond, *Moore* (*n*).	Thomas.
Malaga.	Elvira.	Wylie, *Peter*.
Mission.	Flowers.	
Muscat-Hamburg.	Goethe (*n*).	
Peru, *Rose of*.	Herbemont.	
Prince, *Black*.	Jefferson (*n*).	
Sultana.	Lenoir.	
Sweetwater (*Fontainebleau*).	Lindley (*n*).	
Thompson *Seedless*.	Missouri Reisling [Mississippi Valley].	
Tokay, *Flame*.	Moore *Early* (*n*).	
White Muscat.	Niagara (*n*).	
Zinfandel.	Norton *Virginia*.	
	Salem (*n*).	
	Scuppernong.	
	Tenderpulp.	
	Thomas.	
	Triumph.	
	Wylie, *Peter*.	

PEACHES.

Peaches require a warm climate, and are one of the most important fruits of the Upper and Lower Austral zones. In the Transition zone, except along the southern edge, where the Transition shades into the Upper Austral, they can not be depended on. But in the Pacific Coast division of the Transition, which, as elsewhere explained, receives more heat than the other parts of this zone, peaches are grown in certain localities, and the Hale is said to do well.

Nectarines follow peaches, except in the humid areas, but are of little consequence in the Eastern States. They reach their highest development and greatest commercial consequence in the arid Lower Sonoran.

Zone ranges of peaches.

[KEY.—(*n*), in northern part only.]

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Alexander.	Alexander.
Beers *Smock.*	Beers *Smock.*
Bilyeu.	Bilyeu.
Chili, *Hills.*	Brandywine.
Early Crawford.	Chair *Choice.*
Elberta.	Early Crawford.
Foster.	Early York.
George IV.	Elberta.
Globe.	Foster.
Golden Drop.	Garey.
Grosse Mignonne.	Garfield.
Hale.[1]	Garland, *Governor.*
Heath *Cling.*	Globe.
Hoover.	Golden Cling.
Kenrick *Heath.*	Hale.[1]
Large York.	Heath *Cling.*
Late Admirable.	Late Crawford.
Late Crawford.	Lovell.
Late Rareripe.	Malta.
Morris *White.*	McKevitt *Cling.*
Mountain Rose.	Muir.
Oldmixon Cling.	Newhall.
Oldmixon Free.	Nichols *Cling.*
Red Cheek *Melocoton.*	Orange Cling.
Reeves *Favorite.*	Picquet *Late.*
Richmond.	Reeves *Favorite.*
Rivers.	Rivers.
Salway.	Runyon *Orange Cling.*
Smock.	St. John, *Yellow.*
Sneed.	Salway.
Stevens *Rareripe.*	Smock.
Strawberry.	Strawberry.
Stump.	Stump.
St. John, *Yellow*	Susquehanna.
Susquehanna.	Tuskena (*Tuscany*).
Nectarines:	Waterloo.
Boston.	Wilkins.
Elruge.	*Nectarines:*
Stanwick.	Hunt *Tawny.*
	Red Roman.

[1] The Hale peach is said to do well in the Pacific Coast Transition area, and is the only peach known to thrive in the Transition zone.

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Alexander.	Alexander (*n*).	Angel.
Early Crawford (*n*).	Amelia.	Bidwell Early (*P*).
Early York.	Austin.	Bidwell Late (*P*).
Elberta.	Blood Cling.	Cabler *Indian.*
Foster (*n*).	Blood Free.	Climax.
Garland, *Governor.*	Cabler *Indian.*	Countess.
Hale.	Chinese *Cling.*	Early China (*P*).
Heath *Cling.*	Columbia.	Ferdinand.
Henrietta.	Early Crawford (*n*).	Florida Crawford.
Late Crawford (*n*).	Early York (*n*).	Gibbon.
Lemon Cling.	Elberta.	Honey.
Muir.	Hale (*n*).	Imperial.
St. John, *Yellow.*	Heath *Cling* (*n*).	Maggie *Burt.*
Strawberry.	Hoover.	Onderdonk.
Susquehanna.	Kerr. *Jessie.*	Pallas.
Nectarines:	Late Crawford.	Peen-to (*P*).
Boston.	Lee, *General.*	Waldo.
Downton.	Lemon Cling.	
Early Newington.	Mountain Rose (*n*).	
Early Violet.	Oldmixon Cling (*n*).	
Elruge.	Picquet *Late.*	
Hardwicke.	Sneed.	
	St. John, *Yellow.*	
	Thurber.	
	Tillotson.	

PEARS.

Pears thrive best in the Transition and Upper Austral zones and fairly well in the Lower Austral, though the number of varieties adapted to the latter is relatively small. In the Gulf strip only four varieties flourish.

Zone ranges of pears.

[KEY.—Cross (+), do not thrive in the Upper Mississippi section (Wisconsin, Minnesota, and the eastern Dakotas) except in eastern Wisconsin in vicinity of Green Bay; (*n*), in northern part only; (*s*), in southern part only; (*?*), information sufficiently positive to make the listing necessary, but lacking such full verification as to require qualification.]

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
+Andrews.	Angouleme, *Duchess de.*	Bartlett.
+Angouleme, *Duchess de* (*s*).	Anjou.	Bosc (*s*).
+Anjou (*s*).	Bartlett.	Boussock.
+Bartlett (*s*).	Bosc.	Clairgeau (*s*).
+Bosc (*s*).	Boussock.	Clapp *Favorite.*
+Boussock.	Brandywine.	Flemish *Beauty.*
+Brandywine (*s*).	Clairgeau.	Seckel (*s*).
+Buffum.	Clapp *Favorite.*	Tyson (*s*).
+Clairgeau (*s*).	Columbia.	Winter Nelis (*s*).
+Clapp *Favorite* (*s*).	Easter *Beurre.*	
+Columbia (*s*).	Flemish *Beauty.*	
+Dana Hovey (*s*).	Lawrence.	
+Diel.	Lucrative.	
+Dix.	Onondaga.	
+Elizabeth, *Manning.*	Osband *Summer.*	
+Flemish *Beauty.*	Seckel.	
+Fulton.	Tyson.	
+Giffard (*s*).	Winter Nelis.	
+Goodale.		
+Howell (*s*).		
+Julienne (*s*).		
+Lawrence (*s*).		
+Louise *Bonne de Jersey.*		
+Lucrative (*s*).		
+McLaughlin.		
+Madeleine (*s*).		
+Malines, *Josephine de* (*s*).		
+Onondaga (*s*).		
+Osband *Summer.*		
+Pound.		
+Rostiezer (*s*).		
+Seckel (*s*).		
+Sheldon (*s*).		
+Souvenir *du Congress* (*s*).		
+Sterling.		
+Summer Doyenne (*s*).		
+Tyson.		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Angouleme, *Duchess de.*	Angouleme, *Duchess de.*
Anjou (*n*).	Anjou.
Bartlett (*n*).	Bartlett.
Bloodgood.	Bosc.
Bosc (*n*).	Boussock.
Boussock (*n*).	Brandywine.
Brandywine.	Clairgeau.
Buffum (*n*).	Clapp *Favorite.*
Chambers.	Columbia.
Clairgeau (*n*).	Dana Hovey.
Clapp *Favorite* (*n*).	Diel.
Columbia.	Easter *Beurre.*
Comice, *Doyenne du* (*n*).	Flemish *Beauty.*
Diel.	Glout Morceau.
Easter *Beurre.*	Idaho [local in Idaho].
Garber.	Lawrence.
Giffard.	Louise *Bonne de Jersey.*
Gray Doyenne (*n*).	Lucrative.
Hosenschenk.	Margaret.

Zone ranges of pears—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Howell.	Onondaga.
Julienne.	Osband *Summer*.
Kieffer.	Patrick Barry.
Kirtland.	Seckel.
Lawrence.	White Doyenne.
Louise *Bonne de Jersey*.	Winter Nelis.
Lucrative (*n*).	Vicar *of Winkfield*.
Madeleine (*n*).	
Malines, *Josephine de* (*n*).	
Marguerite, *Petite* (*n*).	
Mt. Vernon (*n*).	
Napoleon (*n*).	
Onondaga (*n*).	
Osband *Summer*.	
Paradise *d'Automne* (*n*).	
Rostiezer.	
Rutter.	
Seckel.	
Sheldon.	
Summer Doyenne.	
Superfin (*n*).	
Tyson.	
White Doyenne (*n*).	
Winter Nelis.	

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Angouleme, *Duchess de*.	Angouleme, *Duchess de* (*n*).	Garber.
Bartlett.	Garber.	Kieffer.
Bosc.	Julienne (*n*).	Le Conte.
Boussock.	Kieffer.	Magnolia.
Brandywine.	Lawrence (*n*).	
Clairgeau.	Le Conte.	
Easter *Beurre*.	Magnolia.	
Glout Morceau.	Rostiezer (*n*).	
Howell (*?*).	Seckel (*n*).	
Lawrence.	Tyson (*n*).	
Louise *Bonne de Jersey*.		
Lucrative.		
Patrick Barry.		
Pound.		
Seckel.		
Superfin.		
Tyson (*?*).		
White Doyenne.		
Winter Nelis.		

PLUMS.

Plums have a wide range. They attain their highest development in the Upper Austral zone, but numerous varieties flourish in the Transition and Lower Austral zones. In the dry summer heat of the Upper and Lower Sonoran areas many varieties develop so much sugar that they make the best of prunes, but in the cooler Transition zone and the more humid Carolinian and Austroriparian areas prune culture is not a success.

Zone ranges of plums (including prunes).

[KEY.—Cross (+), do not thrive in the Upper Mississippi section (Wisconsin, Minnesota, and the eastern Dakotas) except in eastern Wisconsin in vicinity of Green Bay; (*n*), in northern part only; (*s*), in southern part only.]

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
+Arctic, *Moore.*	De Soto.	Agen (*French*, *Petite*, etc.) (*s*).
Aubert, *Yellow.*	Forest *Garden.*	Columbia.
+Bavay *Green Gage.*		Dosch.
De Soto.		Italian (*Fellenberg*).
+Diamond, *Black* (*s*).		German *Prune.*
+Drap d'Or (*s*).		Golden Drop, Coe.
+Duane *Purple* (*s*).		Golden *Prune.*
+Englebert (*s*).		Pond (*Hungarian Prune*).
+German *Prune* (*s*).		Silver *Prune.*
+Golden Drop, *Coe* (*s*).		Tragedy.
+Grand Duke (*s*).		Yellow Egg.
Green Gage.		
+Hudson *River Purple Egg* (*s*).		
+Hulings *Superb* (*s*).		
+Imperial Gage (*s*).		
+Jefferson (*s*).		
+Kingston (*s*).		
+Lawrence *Favorite* (*s*).		
Lombard.		
+McLaughlin (*s*).		
Moldavka.		
+Monroe *Egg* (*s*).		
+Orleans (*s*).		
+Ottoman (*s*).		
+Pond (*Hungarian Prune*).		
+Purple Gage (*s*).		
+Quackenboss (*s*).		
Richland.		
+Shropshire (*s*).		
+Smith Orleans (*s*).		
+Transparent Gage (*s*).		
+Wales, *Prince of* (*s*).		
+Wangenheim (*s*).		
+Washington (*s*).		
Wolf.		
Yellow Egg.		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Abundance.	Agen (*French*, *Petite*, etc).
Agen (*French*, *Petite*, etc.) (*n*).	Bavay *Green Gage.*
Archduke (*n*).	Bradshaw.
Bavay *Green Gage* (*n*).	Cherry.
Bleecker *Gage* (*n*).	Clyman.
Bradshaw (*n*).	Columbia.
Burbank.	German *Prune.*
Chabot.	Golden Drop, *Coe.*
Clinton.	Golden *Prune.*
Columbia (*n*).	Imperial *Gage.*
Copper (*n*).	Italian.
Damson.	Kanawha.
Diamond, *Black* (*n*).	Lombard.
Drap d'Or (*n*).	McLaughlin.
Duane *Purple* (*n*).	Peach.
Englebert (*n*).	Pond (*Hungarian Prune*).
German *Prune* (*n*).	Sergent, *Robe de.*
Golden Drop, *Coe.*	Shropshire.
Grand Duke (*n*).	Silver *Prune.*
Hand (*n*).	Tragedy.
Hudson *River Purple Egg* (*n*).	Washington.
Hulings *Superb* (*n*).	Yellow Egg.
Imperial Gage (*n*).	
Italian (*Fellenberg*) (*n*).	
Jefferson.	
Kerr (*Hattankio 2*).	
Kingston (*n*).	
Lawrence *Favorite* (*n*).	
Lombard.	
Miner.	
Monroe *Egg* (*n*).	
Newman.	

Zone ranges of plums (including prunes)—Continued.

UPPER AUSTRAL ZONE—Continued.

Carolinian area.	Upper Sonoran area.
Ogon.	
Orleans (*n*).	
Ottoman (*n*).	
Peach (*n*).	
Prince *Yellow*.	
Purple Favorite (*n*).	
Purple Gage (*n*).	
Red Nagate.	
Richland (*n*).	
Robinson.	
Saratoga (*n*).	
Saunders (*n*).	
Satsuma.	
Shropshire.	
Smith Orleans (*n*).	
Transparent *Gage* (*n*).	
Washington (*n*).	
Wales, *Prince of* (*n*).	
Wangenheim (*n*).	
Wild Goose.	
Willard.	
Yellow Egg (*n*).	

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Agen (*French, Petite*, etc.).	Abundance (*Botan.*).	Kelsey.
Caddo Chief.	Burbank.	Satsuma.
Columbia.	Caddo Chief [western].	Wild Goose.
El Paso.	Caradeuc, *De.*	
German *Prune*.	Chabot.	
Golden Drop, *Coe*.	Cumberland.	
Italian(*Fellenberg*).	El Paso [western].	
Jefferson.	Georgeson (*Hattankio*).	
Peach.	Golden Beauty.	
Sergent, *Robe de*.	Kerr (*Hattankio 2*).	
Simon (*Prunus simonii*).	Indian Chief.	
	Lone Star.	
	Marianna.	
	Miner.	
	Newman.	
	Red Nagate.	
	Satsuma.	
	Transparent, *Yellow*.	
	Weaver.	
	Wild Goose.	

STRAWBERRIES.

Strawberries taken collectively have a wide range, special varieties being commercially profitable in every zone from the lower edge of the Boreal in Canada to the semitropical strip bordering the Gulf of Mexico. Nevertheless, the strawberry is the product of cool temperate climates, and by far the larger number of varieties are found in the Transition and Upper Austral zones.

Zone ranges of strawberries.

[KEY.—(*n*), in northern part only; (*s*), in southern part only; (*?*), information sufficiently positive to make the listing necessary, but lacking such full verification as to require qualification.]

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
Bubach *No. 5.*	Bubach *No. 5.*	Bubach *No. 5*
Crescent.	Captain Jack.	Clark *Seedling.*[1]
Cumberland.	Jessie (*?*).	Crescent.
Downing, *Charles.*		Everbearing.
Eureka (*s*).		Jessie.
Haverland.		Monarch.
Jessie.		Perry.
Michel *Early* (*s*).		Sharpless.
Miner.		Vick.
Sharpless.		Wilson *Albany.*
Warfield.		
Wilson.		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Bubach *No. 5.*	Bubach *No. 5.*
Crescent.	Captain Jack.
Cumberland.	Clark *Seedling.*[1]
Downing, *Charles.*	Crawford.
Enhance.	Jessie.
Eureka.	Longfellow.
Gandy.	Monarch.
Greenville.	Parker Earle.
Haverland.	Sharpless.
Jersey *Queen.*	Thompson *No. 7.*
Jessie.	
Michel *Early.*	
Miner.	
Parker Earle.	
Sandoval.	
Sharpless.	
Warfield.	
Wood, *Beder.*	

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Australian *Crimson.*	Bubach *No. 5* (*n*).	Hoffman.
Burt.	Cloud [Mississippi Valley].	Michel *Early.*
Longfellow.	Crescent.	Neunan.
Monarch.	Gandy (*n*).	Thompson, *Lady.*
Sharpless.	Hoffman.	
	Michel *Early.*	
	Parker Earle.	
	Thompson, *Lady.*	
	Warfield [Mississippi Valley].	

[1] Markedly successful at Hood River, Oregon, where the Pacific or humid division of the Transition zone merges into the arid Upper Sonoran.

NUTS.

Our native wild nuts, of which the butternut, chestnut, hazelnut, hickorynut, and black walnut are of some commercial importance, are not included in the table, which treats of cultivated kinds only.

Peanuts are grown on a small scale in hot localities in the Carolinian area, in Michigan and Nebraska, and to a greater extent in New Jersey and Delaware, but belong properly to the Austroriparian. Pecans thrive in the Austroriparian and Lower Sonoran areas, but do

best in the Gulf strip. Almonds, though grown sparingly in the Austroriparian area, do not fruit well, and are not a commercial success except in the Lower Sonoran area of California and Arizona, where they and English walnuts are very important crops.

Zone ranges of nuts.

[KEY.—(*h*), in hottest part only.]

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Peanuts (*h*).	*European walnuts:* Chaberte. Franquette. Mayette. Parisienne. Prœparturiens. Serotina. *European chestnuts:* Combale, *Marron.* De Lyon, *Marron.* *Filberts and hazelnuts:* Du Chilly. Lambert. Piedmont. Purple Leaf. Red Aveline.

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Almonds: Blowers. Brier. Drake. Golden State. Gray [southwestern Utah]. Harriott. IXL. King *Soft Shell.* Languedoc. Lewelling. McCoy. Ne Plus Ultra. Nonpareil (*Extra*). Paper Shell. Routier, *New.* Soft Shell, *Routier.* Supremo. Tarragona. Twin, *Routier.* *European walnuts:* Bijou. Chaberte. Cluster. Ford. Franquette. Gant (*Bijou*). Kaghazi. Mayette. Mesange (*Paper Shell*). Mission (*Los Angeles*). Parisienne Prœparturiens. Santa Barbara. Serotina. *Peanuts.* *Pecans.* *Pistachio nut.*	*Almonds.*[1] *English walnuts.*[1] *Peanuts.* *Pecans.*	*Peanuts.* *Pecans.*

[1] Not commercially grown in the Austroriparian area.

MISCELLANEOUS CROPS.

This list is only the merest skeleton. Additions of all kinds, particularly specific information respecting the ranges of definite varieties of garden vegetables, will be thankfully received.

Zone ranges of miscellaneous crops.

[KEY.—(*h*), in hottest part only; (*n*), in northern part only; (*s*), in southern part only.]

TRANSITION ZONE.

Alleghanian (eastern) area.	Arid Transition area.	Pacific Transition area.
Flax (*s*).	Flax.	Alfalfa (*s*).
Hops.	Sugar beet.	Hops.
Maple sugar.	White potatoes.	Sugar beet (*s*).
Sorghum (*s*).		Sweet corn.
Sugar beet.		White potatoes.
Sweet corn.		
White potatoes.		

UPPER AUSTRAL ZONE.

Carolinian area.	Upper Sonoran area.
Cowpeas.	Alfalfa.
Flax.	Cowpeas.
Hemp (Cannabis sativa).	Kafir corn.
Lima beans.	Hemp.
Sorghum.	Lima beans.
Sugar beet.	Sorghum.
Sweet potatoes (*h*).	Sugar beet (*n*).
Tobacco.	Sweet potatoes.
White potatoes.	Tobacco
	White potatoes.

LOWER AUSTRAL ZONE.

Lower Sonoran area.	Austroriparian area.	Gulf strip.
Alfalfa.	China grass.	China grass (for fiber).
Black wattle.	Castor bean.	Cotton.
Canaigre.	Cotton.	Jute.
Castor bean.	Cowpeas.	Rice.
Cork oak.	Jute.	Sea Island cotton.
Cotton.	Lima beans.	Sorghum.
Cowpeas.	Rice.	Sugar cane.
Flax (seed).	Sorghum.	Sweet potatoes.
Hemp.	Sugar cane.	Tobacco.
Mustard.	Sweet potatoes.	
Olive oil.	Tea.	
Opium poppy.	Tobacco.	
Pyrethrum.	Turpentine.	
Ramie.		
Roselle.		
Sorghum.		
Sugar cane.		
Sweet potatoes.		
Tagasaste.		
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TROPICAL FLORIDA.

Camphor. Coffee. Ramie. Sisal hemp. Tobacco.

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